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JULY 1, 1952

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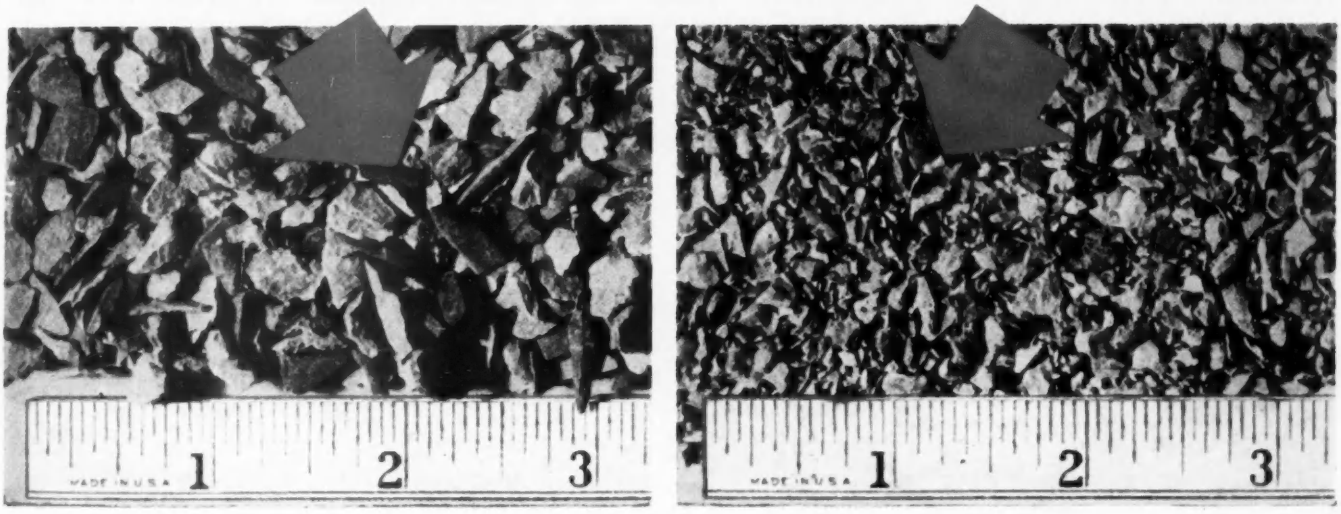
Which bit drilled more hole ...faster?

TWIN-BLAST or conventional?



Just a glance at these cuttings will tell that the **REED** Twin-Blast Bit drilled much faster. Here's why:

Cuttings taken with a conventional bit (right) are small, indicating that considerable recutting had taken place.

Cuttings taken with a Twin-Blast Bit (left) are large, indicating a minimum of recutting. This means more "bite" per revolution, and faster drilling — more footage per bit, and fewer round trips.

Hundreds of bit records show what these cuttings indicate — **REED** *Twin-Blast Bits reduce drilling costs.*

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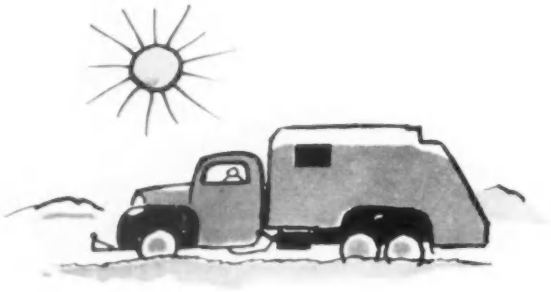

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SCHLUMBERGER!

Iospic

Looking Ahead

CONGRESS MUST KEEP CONSTANT WATCH on activities of the executive branch of government, as demonstrated by recent developments on the tidelands issue. A plan by Interior Secretary Chapman to take over the tidelands under the Surplus Property Act was dropped after a Senate investigation. Meanwhile, Senate action still was pending in late June on the President's veto of legislation passed by Congress which confirmed state title to submerged lands. There were indications that the Senate, doubtful that it could succeed, would attempt to over-ride veto this year.

PAD SAYS IT WILL BE NECESSARY to drill 60,000 wells in 1954 and 65,000 in 1955 to provide essential reserve crude oil production capacity. This compares with present goals of 55,000 wells in 1953 and 25,000 in latter half of 1952. Similar expansion of tubular goods is urged.

MORE THAN 1 MILLION new gas house-heating customers are expected to be added by the gas utility industry during 1952-1953 heating season. About same number in 1953-1954, compared with addition of 1½ million customers in '51-'52 season.

TO HELP PREVENT SHORTAGE OF HEATING OIL next winter, it may become necessary that restrictions be placed on exports of that product.

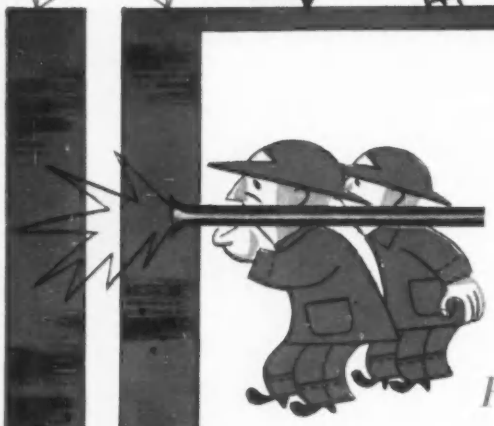
STATES' RIGHTS TO SET MINIMUM PRICES on sales of gas produced for interstate shipment likely will be tested in courts, though Supreme Court upheld Oklahoma's power to fix minimum price as conservation measure in case involving only production of gas for sale within the state. Federal Power Commission has ruled in Northern Natural Gas Company case that Kansas' price setting power does not extend to gas produced by an interstate pipe line for interstate shipment. FPC said Northern's own gas production that goes into interstate commerce must be figured at cost in determining base rates instead of at minimum price of 8 cents per thousand cubic feet set under Kansas law for gas sales. FPC said Northern could apply that legal minimum only to gas it purchases.

CONSIDERABLE SIGNIFICANCE IS ATTACHED to Phillips Petroleum Company's late-June discovery of gas in Ellenburger in the southeastern part of the Delaware Basin of West Texas. Located 25 miles from nearest previous Ellenburger producing pool, the strike promises to lead to additional oil and gas discoveries over a large area. The well, Glenna 1, 25 miles southeast of Fort Stockton, Pecos County, is expected to have potential of 100 million cubic feet per day from Ellenburger dolomite, topped at 13,605 feet and penetrated to 14,522 feet.

A TREND TOWARD DEEPER DRILLING in the Permian Basin is emphasized by Magnolia Petroleum Company's recent completion of a wildcat in northeastern Andrews County, West Texas, as deepest oil producer in the basin or in Texas. Drilled to 13,918 feet, the well initially flowed 555 barrels per day of 44.7 gravity oil through ½-inch tubing choke when completed through perforations from 13,840 to 13,884 feet in Ellenburger formation.

WORLD OIL'S 1952 INTERNATIONAL OPERATIONS ISSUE, due out July 15, will give comprehensive coverage of world operations and development, including large insert maps in color showing oil and gas fields, pipe lines and refineries.

GET THESE WELL PERFORATING EXTRAS *with* DOWELL *Perfo-Jet Service*



When you call for Dowell Perfo-Jet Service you get a bonus of extras whic pay off in better casing perforating and open hole shooting. These extr give you more accurate gun positioning . . . maximum performance of th shaped charge . . . surer, deeper penetration . . . a junk-free hole . . . le possibility of sticking the gun . . . equipment to meet your well conditions . laboratory and field tested methods . . . an active safety program . . . twen years of experience in oil field servicing.

Contact the Dowell office near you for more complete information abou how Perfo-Jet and the many other Dowell Services can help you solv your production problems.

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ELECTRIC PILOT EQUIPMENT—The Electric Pilot houses instruments for finger-tip operation and the direct recording of subsurface data. The cable drum, driven by hydraulic motor, is easily and positively controlled. The Dowell sonic collar locator assures accurate gun positioning. With the Electric Pilot truck on the job, the other Pilot Services can be combined with Perfo-Jet on the same trip to your well—Permeability, Spinner, Caliper and Water Location Surveys and Selective Acidizing.

MAXIMUM JET FORMING AREA—The shaped charge used in Dowell Perfo-Jet guns is assembled so that the charge positioning sleeve does not obstruct the critical jet forming area. This Dowell feature allows the jet to give maximum performance—deep, sure penetration through casing and cement into the producing zone.

SELF-DESTROYING GLASS GUN—The expendable Glass Gun, developed by Dowell, carries a larger amount of explosive for greater penetration. When the charges are fired, the glass containers and their aluminum carrier are completely destroyed leaving a junk-free hole. Dowell Glass and steel-type guns are tailor-made in size and shooting patterns to fit we conditions. Perforations rang from ¼" up to ⅜" in diameter

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Editor's Page

Land of the Free?

THE SITUATION with regard to the steel strike rapidly is getting completely out of hand. Irreparable damage will be inflicted on the economy of the nation. Widespread staggering losses in wages, production, profits and taxes will occur unless a settlement is reached quickly.

Few lines of business will escape the dire consequences. An acute slowdown of United States industrial activity now is but a matter of days. Such direct defense operations as the manufacture of shells, tanks and rockets cannot continue without steel. Extensive cutbacks are to occur immediately in automobile, household appliances and many others. Along with many others, the oil industry is feeling the effects of the steel strike. Due to shortages of tubular goods, many oil companies are being forced to curtail their drilling operations.

Vast numbers of workers in widely varied fields of endeavor face prospects of being laid off. They will suffer tremendous wage losses. Corporations everywhere will experience terrific financial and production losses. The whole national economy will be hit hard.

• • •

THE GREAT QUESTION which has brought the steel strike to an impasse is the union demand that compulsory union membership be imposed on all steelworkers. Grave and threatening indeed are the issues raised by this request for compulsory union membership.

A basic principle of the nation is imperiled. Depriving workers of the freedom to choose for themselves whether they will or will not join any organization would constitute forced socialism.

Is this America, the land of the free? Will it continue tomorrow as the land of the free if such conditions are imposed on its workers? This principle is so vital to the American way of life it must be resisted resolutely despite the tremendous economic consequences which will result from prolongment of the steel strike.

Warren L. Baker

duplex

DUPLEX

.....a good name to remember

Baker DUPLEX Cement Wash-Down Whirler Float Shoe — Product No. 360

WHAT YOU CAN DO WITH BAKER DUPLEX EQUIPMENT

successfully cement liners, combination strings, and perform certain types of two-stage cementing.

cement blank sections of pipe below a perforated section, without any need to use auxiliary equipment.

wash out cavings ahead of the string when setting a liner. Without DUPLEX Equipment you can circulate only through the topmost perforations—with DUPLEX you can circulate clear to bottom.

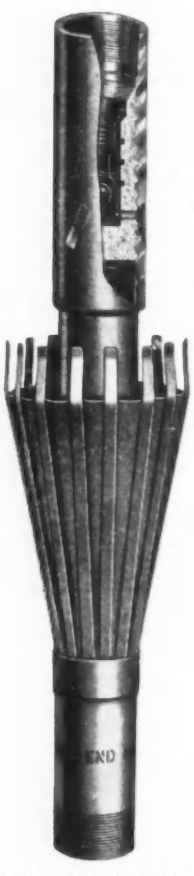
you can control the amounts of materials used, and (without change) run caustic or oil, then run plastic, in sequences and quantities as desired.

you eliminate the need for auxiliary equipment (such as retainers or retrievable cementers) when you use Baker DUPLEX.

you can use DUPLEX equipment either with or without a liner hanger.

you have complete control of the liner at all times when DUPLEX Equipment is used. The liner can be raised or lowered, and is positively held down in place while cementing.

a bridging ball can be dropped (after cementing) and circulation carried on above the DUPLEX Equipment without disturbing the green cement.



Baker Combination Product No. 383 with a DUPLEX Whirler Float Collar. Cement is held above the Metal Petal Basket.

How DUPLEX Equipment is made

DUPLEX Float Shoes and Collars are similar to other Baker Float Shoes and Collars in most features, but have a female left-hand thread assembly (of drillable cast iron) accurately anchored just above the Back-Pressure Valve. By means of a mating male Left-Hand Square Thread Sub, the cementing string is easily connected to (or disconnected from) the DUPLEX Shoe or Collar.

How DUPLEX Equipment Operates

In simple liner work, a DUPLEX Wash-Down Whirler Float Shoe is connected to the bottom joint and the balance of the liner is run into the well, with the last joint held in slips or clamps. A cementing string of sufficient length then is run to connect the male Left-Hand Square Thread Sub to the female left-hand assembly in the shoe, to form a quick, fluid-tight connection.

The portion of the cementing string above the liner is then run, with the DUPLEX connection carrying the weight of the liner. After cementing, the back-pressure valve prevents any flow-back of cement slurry placed outside the liner. The cementing string is then disconnected by rotating to the *right;* excess cement washed out; and the cementing string removed from the well.

Various combinations of Baker DUPLEX Equipment are used to perform more complex operations, such as cementing behind liners at different levels; cementing above and below cavities; between producing zones; and similar work.

The Baker representative or office nearest you is available to discuss proper use of Baker DUPLEX Equipment in your well completions.

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The Changing Panorama

Petroleum Industry's Achievements Praised

THE PETROLEUM industry's record of achievement and its current operations were given the stamp of approval, in effect, by the report presented June 23 to President Truman by his Materials Policy Commission, headed by William S. Paley.

The commission's study of petroleum and gas supported with effective arguments the desirability of the depletion allowance in the income tax provisions. Moreover, the report favored additional "expensible" exploration and development costs.

Predicting a 110 percent increase in U. S. demand for petroleum products by 1975, the commission said that the country must "welcome" crude oil imports and reduce or eliminate tariffs. It also foresaw eventual need for commercial production of synthetic liquid fuels, made from shale at first and later from coal.

Meanwhile, an early settlement of the tidelands issue and development of the potential offshore reserves were urged.

The report expressed a view, generally agreed with by the industry, that the military concept of "sterilized" oil reserves—for use in emergency—is impractical. The problem of making sure that there will be enough oil for national defense can best be solved and handled by the industry, in the opinion of the Paley commission.

Industry on Lookout For Earth Scientists

EMPLOYMENT OPPORTUNITIES are expected to be good in the earth sciences in the early 1950's, especially in the petroleum and mineral industries and in government service.

Geologists and geophysicists are needed to provide more petroleum and minerals; meteorologists, to furnish additional weather data for air force operations; geographers, to supply information on foreign countries important in defense planning; oceanographers, for research on submarine operations and amphibious landings.

The earth scientists in greatest demand are those with extensive training and experience who are able to organize and direct either research projects or operating programs. In certain highly specialized areas, such as research geophysics and meteorology, the letting of government contracts has resulted in acute shortages of qualified research personnel. As the defense program progresses, it is likely that shortages of highly trained personnel will become more acute. Therefore, employment opportunities will improve for those with only the bachelor's degree who try to enter professional work. Though the number of students receiving graduate degrees in the earth sciences has increased considerably since World War II, the supply is still below the demand.

About 25,000 persons in the United States work professionally in the earth sciences. Half are in geology and the closely related fields of paleontology, mineralogy, and geological engineering. Geophysicists, meteorologists, oceanographers and other related specialists probably account for as many as 10,000 earth scientists. Between 1500 and 2000 persons are professional geographers.

The long-run outlook for earth scientists who obtain graduate training is also good. Teaching will continue to be a major source of employment, with a greatly increasing demand for personnel in the 1960's expected. Other areas of employment which may expand greatly in the future are urban, regional, and river basin planning and development; utilization of the oceans as sources for food and minerals not now obtainable; weather control, rainmaking, and large scale irrigation; tapping the interior crust of the earth for metallic ores; and the search for new mineral resources useful in the development of atomic energy. These and many other projects will require the services of earth scientists.

Study Emphasizes Oil's Investment

THE PETROLEUM industry's heavy investment for serving the country, in terms of both total capital and investment per employe, is emphasized by study of a report in the June issue of the National City Bank's monthly letter on the subject, "Who Is Big Business?" The report lists the 100 largest manufacturing companies in the U. S. at end of 1951, on the basis of assets. Twenty of them are oil companies.

Although the average investment of the 100 corporations was $14,000 for each employe, the bank letter showed an average of $37,000 for petroleum. This was comparable with the $40,000 investment per employe for distilling and $50,000 for tobacco products, and compared with $17,000 for chemicals, $15,000 for non-ferrous metals, $14,000 for paper, $13,000 for textiles, $11,000 for steel, $10,000 for machinery and equipment and approximately $7000 per employe for companies making tires, automobiles, electrical equipment and food products.

Total assets of the 100 largest manufacturing companies, after deducting reserves for depreciation, were $60,128,000,000, of which the 20 oil companies accounted for $19,345,000,000 or 32.2 percent.

This was an average investment of nearly $1 billion per oil company, though the actual assets ranged from $4.7 billion for Standard Oil Company (New Jersey), largest of all the 100 companies, down to about $¼-billion to $½ billion per company for ten of the 20 oil companies listed.

The 100 large companies included 12 with assets exceeding $1 billion, and six of the 12 were oil companies, including Standard of New Jersey, Standard Oil Company (Indiana), Socony-Vacuum Oil Company, The Texas Company, Gulf Oil Corporation and Standard Oil Company of California, in that order. The other six billion-dollar concerns were the General Motors, U. S. Steel, du Pont, Bethlehem Steel, General Electric and Westinghouse Electric.

The report also lists 31 manufacturing companies that reported more than 50,000 stockholders at the close of 1951. These include eight oil companies.

Report from the Observatory

Trends Move in Right Direction

By RAY L. DUDLEY, Publisher, and WARREN L. BAKER, Editor

MUCH PROGRESS in solving the peculiar supply problems created by the recent refinery strike will occur by the end of July. However, the industry will not be out of the woods completely by that time.

Peak refinery runs and reduced crude production are promised for July. These actions will go far toward draining off sizable portions of excessive crude stocks, while simultaneously rebuilding inventories of refined products to more desirable levels.

Despite anticipated improvement in July, further progress still will be necessary to again restore inventories to normal status. The industry faced a whale of a job and cannot hope to overcome all effects of the strike immediately. Quick adjustment of storage volumes could be accomplished only through unnecessary and undesirable extreme ups and downs in producing rates. The wiser course would be to move with care and caution in the months ahead. This burden will fall chiefly upon the Texas Railroad Commission, Texas producers and purchasers. If Texas allowables are curtailed further in coming months, it probably would become necessary to boost producing rates late in the year. It would be more advantageous to follow a more even production pattern and avoid extreme fluctuations.

• • •

SEVERAL PROBLEMS need careful study. One is the maladjustment of stocks by geographical regions. A larger portion of refining plants depending on West Texas and upper Mid-Continent crude were involved in the strike than in the Gulf and East Coast regions. Consequently, more West Texas and Mid-Continent crude went to storage, and this territory also experienced heavier drafts on refined inventories than did the Gulf and East Coast regions.

The contrasting needs of the two major regions must be considered in fixing production allowables. Enough crude must be provided Coast plants without overburdening Mid-Continent refineries. Inability to ship crude between the two sectors makes this problem harder to solve than it might seem. It would be helpful for West Texas allowables to be held in check for several months although higher allowables are given other Texas areas. But it is questionable if the commission will forget its "across-the-board" policy of fixing permissible rates between districts.

• • •

THE IMMEDIATE OUTLOOK is for July to go a long ways toward solving supply problems created by the strike. The combination of high refinery runs and reduced producing rates will replenish low inventories of refined products and reduce excessive crude stocks.

Refinery runs climbed to peak levels in early June and should advance further in July. Crude runs climbed to 6¾ million barrels daily by mid-June in contrast with a former peak of 6⅔ million barrels last February. When all strike-bound plants resume operations, refinery runs may reach 6,850,000 barrels per day.

Meanwhile, crude production will be at 17-month low in July. The fourth consecutive monthly cutback dropped Texas' July permissive output to 2,707,276 barrels per day. Thus, Texas' production will be the lowest since March, 1951, about 164,000 barrels under mid-June and 250,000 barrels per day beneath peak reached in March this year.

Inventories of crude increased 20 million to an excessive volume totaling 288 million barrels during the strike, highest since 1938. They need to be reduced by 30 to 35 million barrels. The first two weeks of June brought a reduction of only 3 million barrels, but a substantial increase in the withdrawal rate should occur with higher refinery runs and lower production during July.

Record quantities of products will be manufactured under the impetus of peak refinery runs, permitting replenishment of low inventories.

Chief concern is distillate fuel stocks. They definitely are on the low side. Whereas distillate inventories were 3½ million barrels above year ago levels at the start of the strike, the end of May found them 8 million behind 1951 volumes. High refinery runs already had cut this margin of difference to 6½ million barrels by June 14. Prospective record refinery output, abetted by an 0.8-cent-per-gallon boost in fuel oil price ceilings, will bring substantial improvement during July.

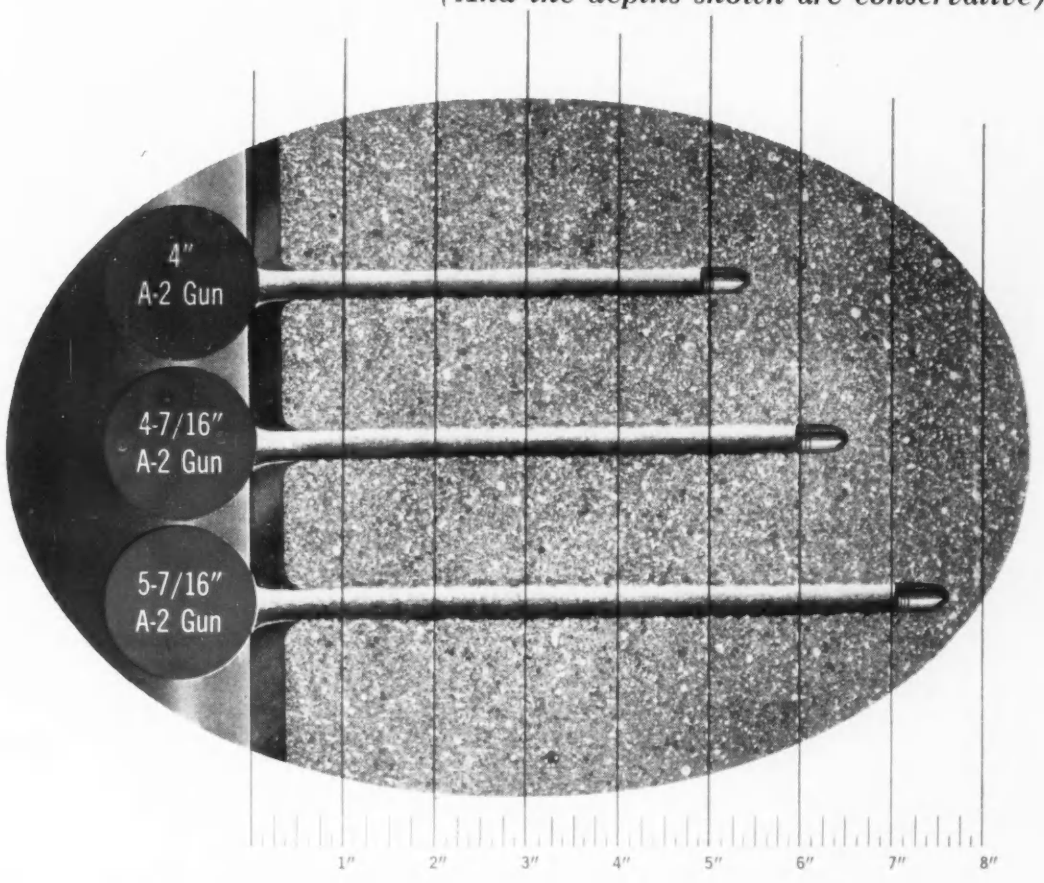
Motor fuel inventories in mid-June were 16 million barrels below 1951 volumes although they had been 9⅓ million greater when refinery workers struck. Here again, heavy production will bring major changes by the end of July.

• • •

THE CRUCIAL PERIOD ahead will be August. With current trends moving affairs of the industry in the right direction, the degree of progress made in July needs to be studied carefully to determine the best course of action in future months. The success of the industry in properly appraising its conditions at the end of July and in adjusting its operations accordingly will have an important bearing on its operations for months to come.

With penetration like this, it's no wonder so many operators use our A-2 gun!

(And the depths shown are conservative)



When the A-2 Gun was introduced, only a year ago, we promised operators 28% to 47% greater penetration . . . results in the field more than equalled that promise. As a result of the amazing performance of this new gun, we're hard put to keep up with the demand, in field after field, for A-2 perforating. But, every day, we're getting more and more A-2 Guns in all three sizes into service, so you won't have to wait. Call your nearest Lane-Wells man . . . he'll see that you get prompt service with the A-2 Gun which fits your needs best.

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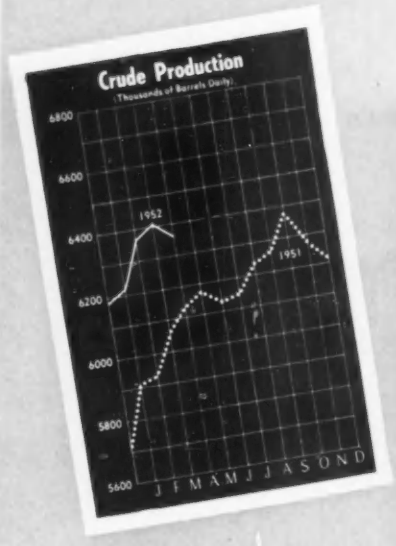
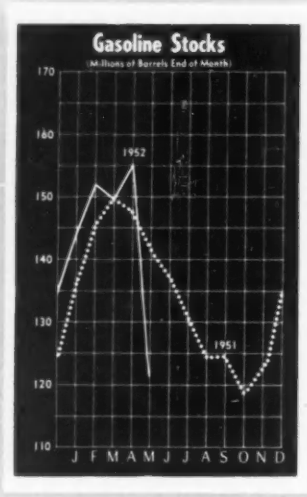
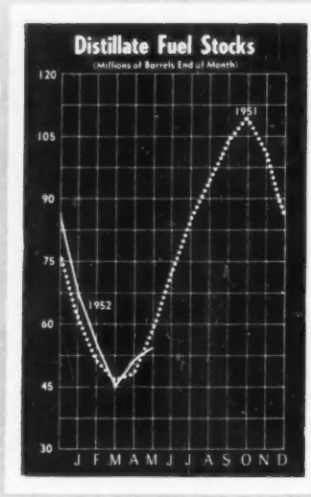
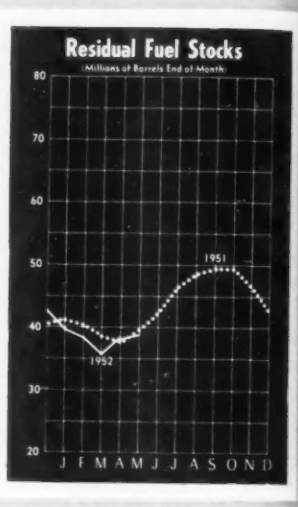
Petroleum T

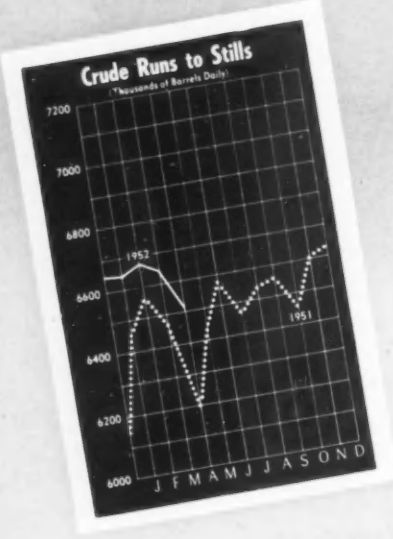
By CECIL W. SMITH, WOR

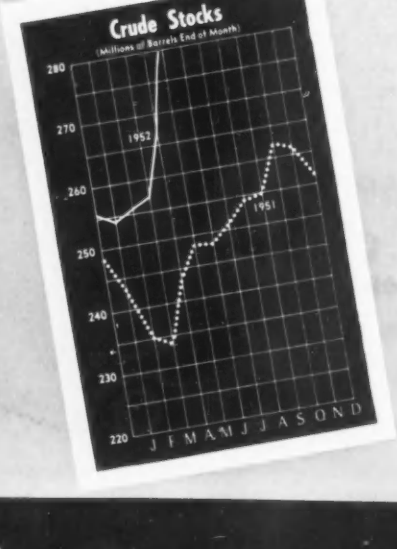












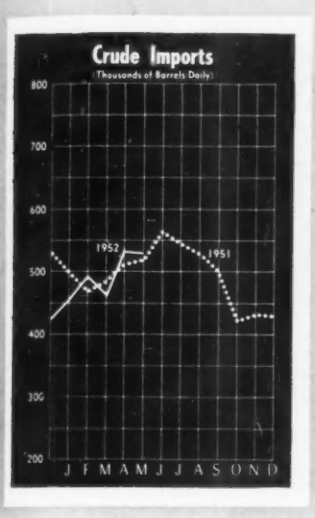
U. S. Crude Production by States

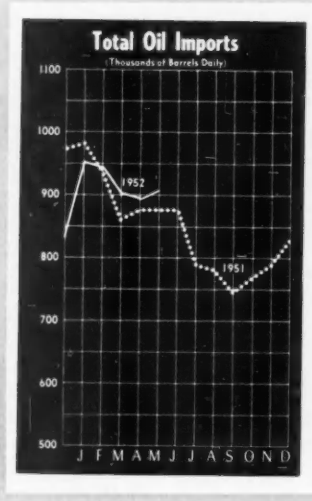
(THOUSANDS OF BARRELS)

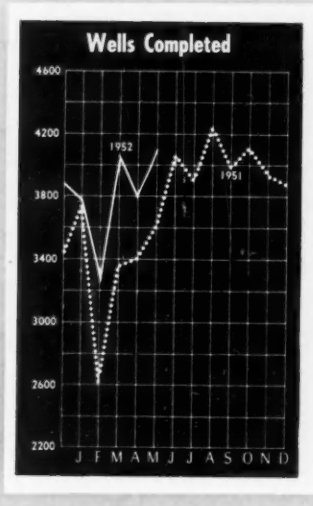
STATE or DISTRICT	DAILY AVERAGE PRODUCTION June 1, 1952	May 1, 1952	June 1, 1951	% Diff. June 1, '51-'52	TOTAL PRODUCTION First Four Months 1952	1951	% Diff. '51-'52
Alabama	2.7	2.7	3.0	— 10.0	323	327	— 1.2
Arkansas	80.6	80.8	83.1	— 3.0	9,799	9,771	— 0.1
California	985.5	978.2	966.3	+ 2.0	118,024	115,349	+ 2.3
Colorado	78.3	83.3	73.8	+ 6.1	9,805	9,040	+ 8.5
Florida	1.8	1.8	1.7	+ 5.9	206	189	+ 9.0
Illinois	169.2	169.3	169.5	— .2	19,775	19,320	+ 2.4
Indiana	32.4	30.9	28.9	+ 12.1	3,670	3,082	+ 19.1
Kansas	248.7	318.2	312.5	— 20.4	39,039	37,273	+ 4.7
Kentucky	34.0	35.1	27.9	+ 21.9	4,301	3,389	+ 26.9
Louisiana	665.6	663.2	644.7	+ 3.2	79,441	75,829	+ 4.8
North Louisiana	125.1	128.1	129.9	— 3.7	14,881	14,452	+ 3.0
South Louisiana	540.5	535.1	514.8	+ 5.0	64,560	61,377	+ 5.2
Michigan	34.0	37.3	38.3	— 11.2	4,516	4,733	— 4.6
Mississippi	97.3	99.5	103.9	— 6.4	12,143	12,330	— 1.5
Missouri	0.1	0.1	0.1	.....	9	9	.....
Montana	23.4	23.1	24.0	— 2.5	2,916	2,853	+ 2.2
Nebraska	6.0	6.6	7.5	— 20.0	711	971	— 26.8
New Mexico	162.6	161.3	141.6	+ 14.8	19,305	16,803	+ 14.9
New York	13.4	14.6	15.0	— 10.7	1,510	1,376	+ 9.7
North Dakota	2.0	1.3	0.1	+2000.0	60	3	+1900.0
Ohio	8.2	8.8	8.3	— 1.2	1,038	1,020	+ 1.8
Oklahoma	526.3	531.3	504.2	+ 4.4	64,144	60,441	+ 6.1
Pennsylvania	28.5	30.2	30.2	— 5.6	3,560	3,826	— 7.0
Tennessee	0.1	0.1	0.1	.....	4	5	— 20.0
Texas	2,700.9	2,839.7	2,791.5	— 3.3	348,971	318,611	+ 9.5
Dist. 1—South Central	31.8	34.0	33.7	— 5.6	4,025	3,935	+ 2.3
Dist. 2—Middle Gulf	147.6	160.7	166.9	— 11.6	20,115	19,093	+ 5.4
Dist. 3—Upper Gulf	462.6	485.0	503.4	— 8.1	59,484	58,110	+ 2.4
Dist. 4—Lower Gulf-S.W.	241.6	260.4	261.1	— 7.5	31,956	29,646	— 7.8
Dist. 5—East Central	54.4	59.3	53.0	+ 2.6	7,217	5,814	+ 24.1
Dist. 6—Northeast	389.7	392.3	392.8	— .8	47,951	45,983	+ 4.3
Dist. 7-B—North Central	92.6	89.8	86.4	+ 7.2	10,600	9,543	+ 11.1
Dist. 7-C—West Central	137.7	137.4	104.0	+ 32.4	16,853	10,908	+ 54.5
Dist. 8—West	897.1	976.9	946.8	— 5.3	120,652	106,222	+ 13.6
Dist. 9—North	163.2	161.1	154.8	+ 5.4	19,450	18,091	+ 7.5
Dist. 10—Panhandle	82.6	82.8	88.6	— 6.8	10,033	10,758	— 6.7
Utah	4.2	4.3	3.4	+ 23.5	481	419	+ 14.8
Virginia	0.1	0.1	0.1	.....	8	4	+ 100.0
West Virginia	6.8	6.2	6.8	.....	889	898	— 1.0
Wyoming	168.2	168.6	183.6	— 8.4	22,194	22,704	— 2.3
Total United States	6,080.9	6,629.6	6,170.1	— 1.5	766,822	720,575	+ 6.4

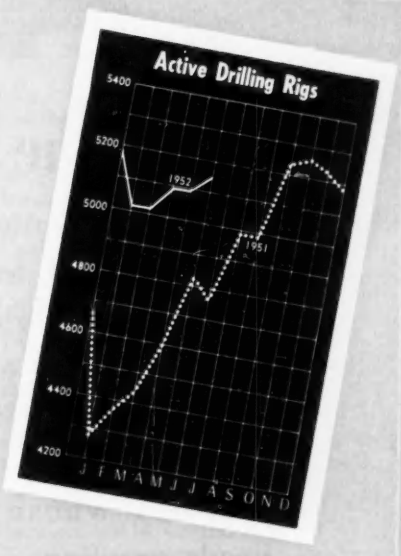
Trends in U. S.

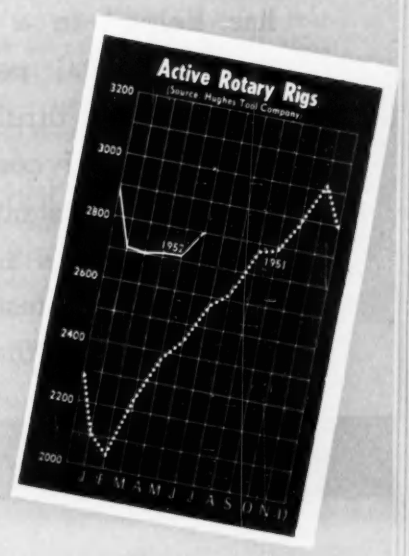
WORLD OIL Staff











Crude Oil and Refined Products Trends

(THOUSANDS OF BARRELS)

MONTH	CRUDE OIL			GASOLINE		DISTILLATE FUEL		RESIDUAL FUEL		DAILY IMPORTS	
	Production Daily	Runs to Stills Daily	Stocks End of Month	Production Daily	Stocks End of Month	Production Daily	Stocks End of Month	Production Daily	Stocks End of Month	Crude Oil	Total Oils
1950:											
April	4,968	5,193	244,605	2,508	128,057	977	37,530	1,048	39,979	511	888
May	5,143	5,535	239,877	2,647	121,035	997	42,739	1,063	39,482	439	766
June	5,378	5,655	242,287	2,748	114,074	1,037	53,679	1,069	40,124	498	838
July	5,484	5,882	240,270	2,835	111,055	1,040	62,555	1,140	42,165	486	806
August	5,665	6,067	237,393	2,932	107,067	1,089	68,426	1,148	40,979	501	839
September	5,888	6,059	242,311	2,849	105,748	1,180	78,270	1,178	41,966	525	859
October	5,900	6,077	246,424	2,875	105,764	1,217	85,643	1,250	45,004	510	896
November	5,891	6,085	250,016	2,859	109,005	1,218	86,113	1,240	45,048	466	891
December	5,719	6,143	248,463	2,879	116,769	1,343	71,948	1,306	40,750	530	974
1951:											
January	5,907	6,450	243,107	2,962	136,145	1,427	62,163	1,368	41,251	499	977
February	5,930	6,562	235,247	2,906	145,184	1,419	51,348	1,382	40,716	468	937
March	6,052	6,469	233,824	2,908	149,679	1,327	46,744	1,348	38,366	483	861
April	6,127	6,183	243,180	2,821	147,679	1,171	48,239	1,230	37,623	511	871
May	6,170	6,436	248,418	3,031	141,658	1,210	59,272	1,265	39,879	518	876
June	6,130	6,575	248,170	3,100	137,009	1,254	72,140	1,277	42,398	563	876
July	6,141	6,462	250,847	3,091	130,931	1,228	84,282	1,275	46,320	546	788
August	6,232	6,539	254,276	3,114	124,202	1,237	94,028	1,226	48,365	529	780
September	6,261	6,558	254,900	3,127	124,530	1,282	104,082	1,228	49,608	500	744
October	6,375	6,446	262,266	3,105	118,864	1,295	109,544	1,224	49,573	421	769
November	6,272	6,609	261,100	3,130	122,723	1,358	101,666	1,304	46,491	425	802
December	6,182	6,646	255,783	3,150	134,867	1,442	93,619	1,313	42,853	423	834
1952:											
January	6,217	6,640	254,007	3,094	144,339	1,456	66,969	1,338	39,523	488	951
February	6,367	6,673	255,900	3,109	151,912	1,528	55,369	1,322	38,295	491	940
March	6,388	6,640	259,126	3,069	160,689	1,400	48,750	1,274	37,971	510	947
April	6,360	6,503	267,543	3,033	155,367	1,326	51,274	1,274	38,526	536	894
May	*	*	288,026	*	121,894	*	50,966	*	38,523	529	901
May, 1952: Change											
In Month	*	*	+20,483	*	—33,473	*	—308	*	—3	—7	+7
In Year	*	*	+39,608	*	—19,764	*	—8,306	*	—1,356	+11	+25
Week Ended:											
6-14-52	6,149	6,762	284,906	3,115	121,993	1,471	57,944	1,288	40,889	614	869
6-16-51	6,189	6,588	248,566	3,128	137,905	1,219	64,429	1,310	40,609	690	943

* Not available due to refinery strike

What is the Greatest of Executive Satisfactions?

It has been gratifying to see our business grow from humble beginnings to a worldwide organization with over 5000 employees.

It is pleasant to realize that we have met every challenge of an industry whose pace is fast and needs exacting . . . and agreeable to know that the service we perform has helped in a substantial way to conserve vital petroleum resources.

There is a thrill, too, in observing the results of consistent, long-range research — constantly improved processes, methods and equipment.

But the greatest satisfaction of all lies in the fact that, in our own way, we have provided a practical demonstration of the American system at work. By converting volume, experience, equipment and research into better service sold at less cost, we have expanded our market, provided employment for more and more people and in some degree reduced the cost of a basic commodity.

The cost of the average Halliburton cementing job is less today than it was in 1924.

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Chairman of the Company

HALLIBURTON OIL WELL CEMENTING CO.

Duncan, Oklahoma

Monthly News Analysis

Cutback in Texas Means Tight Supply for Some

Sharply lower crude oil production in Texas under July allowables will reflect the after effects of the refinery strikes of May. The reduced output will please some crude purchasers, especially those who got overstocked on Permian basin crude during the strikes. But the lower allowables will mean tight supplies of crude for other companies, especially concerns operating plants on the Gulf Coast.

The varying effects on different companies will be due in considerable part to the well established but often criticized policy of the Texas Railroad Commission under which allowable reductions or increases are made "across the board"—applying proportionately to all districts of the state. The present situation is one in which all districts have lower allowables partly because reduced quotas were needed in West Texas.

However, the strikes had caused substantial increases in crude stocks generally in Texas and elsewhere, and it is the opinion of the Texas Railroad Commission that the crude inventories are excessive and wasteful and should be drawn upon for some of the crude currently needed, making lower current production of crude essential.

In its order issued June 18, the Texas commission cut the Texas allowables for July by 164,017 barrels daily from the current output, to a total of 2,707,276 barrels per day.

This was the fourth consecutive monthly cut in Texas allowables and brought to about 424,000 barrels the combined reductions from the record output of March. Under the July order, there will be 18 producing days generally for the fields of the state and 19 for the East Texas field. This means one less producing day than in June, despite July's extra day on the calendar.

The 19 producing days ordered for East Texas was in compliance with the recommendations of most of the Texas crude purchasers represented at the statewide hearing that preceded issuance of the July order. But purchasers differed generally on the number of producing days needed for the rest of the state. Magnolia Petroleum Company advised 18 days, as ordered by the commission, but both Stanolind Oil Purchasing Company and Cities Service Company favored 17, and Shell Oil Company, with its Houston refinery still idled by a strike, asked only 15.

More than the 18 producing days had been requested by various companies. Nineteen days were sought by Atlantic Refining Company, The Texas Company, and Gulf Oil Corporation, which revealed they were short of crude. Gulf said it was drawing 20,000 barrels a day from stocks.

Humble Oil & Refining Company, largest Texas crude purchaser, officially recommended 20 producing days for the state generally and 19 for East Texas, but indicated it could use 23 days' production. Even a 20 day basis would require withdrawal of 50,000 barrels daily from storage and some spot market purchases of crude, an Humble representative stated, and less than 20 days would mean Humble would be unable to supply local demands for refineries in the Corpus Christi area.

Another Humble spokesman said Texas would have to produce about 21 days monthly the rest of the year to supply demand and even then there would be some drawing on stocks. He added that U. S. crude stocks of about 285 million barrels were not alarming in spite of industry leaders' advice last year that 250 to 260 million barrels were adequate, since new pipe lines subsequently built require 10 million barrels for line fill.

What surplus crude is in storage is at wrong places, unavailable to refiners needing more oil, the Humble representative added.

Sun Oil Company recommended 21 producing days for the state in general, and Sinclair Oil Corporation advised 22, both indicating they were short of crude.

In advocating only 17 producing days generally, a representative of Stanolind Oil Purchasing Company said that program would fill Stanolind's requirements. Noting current crude stocks of 285 million barrels, he said his company considered that quantity "excessive and wasteful."

Industry Expansion Plan Is Upset by Steel Strike

Governmental planners' programs for expanded industrial and military output have been upset. This turn of events has been credited to the failure of Truman-directed planners to force the Wage Stabilization Board's recommendations for increased wages on the steel industry through coercion and illegal seizure and the subsequent strikes by the CIO Steelworkers Union. The situation also has put off for the immediate future the possibility of relaxation of government controls over materials allocations.

The loss of steel production means serious impairment of the expansion program designed by the Petroleum Administration for Defense to increase crude oil producibility by 867,000 barrels daily for possible military needs by the end of 1953. Just how far this expansion plan has been set back is not immediately known. All industrial and military programs have suffered an irreplaceable loss of steel. Now the entire future allocations of the essential material will have to be revised, in line with total steel production to be available during the remainder of this year and 1953—the long-range scope of most government-directed expansion programs.

The sudden turn towards a tighter steel supply came just as some improvement in materials availability was beginning to result from the continued high producing rates of the steel industry, operating for nearly two years at or near total capacity. For the oil industry, the stoppage of steel production could be interpreted into loss of output of 4966 tons of oil country tubular goods and 9526 tons of line pipe of all sizes for each day the mills remained idle. This is a real loss, since with some slippages in allocations in 1951 and 1952 even with steel mills operating at full capacity, there is no possibility of "making up" production loss during the strikes.

To kick off its 18-month expansion program, which called for drilling 25,000 domestic wells in the last six months of 1952 and 55,000 new wells in the U. S. in 1953 of an over-all domestic and foreign 90,120-well plan, PAD gave domestic operators tickets for allocation of 458,300 tons of drill

pipe, tubing and casing for the July-September quarter. This included primary and supplemental allotments, allocations of conversion steel for making pipe, and "set-asides" for field emergency stocks. This quarterly allocation is at the rate of 152,800 tons of oil country tubular goods per month, or close to the domestic steel industry's monthly capacity to produce. Actually, the third quarter allocation is estimated by PAD officials to be approximately 25,000 tons less than needed by operators, or no more than 93 percent of requirements for the quarter.

Previous quarterly allocations have been at or near the steel industry's productive capacity of oil country tubular goods. As a result inventories have been depleted, available used pipe heavily drawn upon and there has been a sharp rise in imported pipe from Western Europe. Total imports of pipe and tubes, of not less than 3/8-inch diameter and pipe and tubes of iron and steel not specified (the only classifications listed by the Department of Commerce) jumped from 5440 tons in 1949 to 40,375 tons in 1950 and 238,623 tons in 1951. In February of this year, the latest month for which figures are available, pipe imports were 19,727 tons, down slightly from the 20,562 tons of February, 1951.

Total domestic production of oil country tubular goods this year, however, has been running behind 1951. In the first five months before the strike began on June 2, total output reported by American Iron & Steel Institute amounted to 745,444 tons, or an average of 149,089 tons per month. The total for the like period of 1951 was 776,432 tons. Assuming full production will be maintained in July, August and September, total domestic output of oil country tubular goods would be 450,000 tons, or 8300 tons less than has been allocated for use in the quarter. The remainder would have to be filled from any available inventories, used pipe or imports —or probably added to the already mounting slippages.

With many of the urgently needed crude oil, refined product and natural gas transmission lines completed or nearing completion, pressure for line pipe has been eased since the first quarter of the year. This, plus the new facilities for making large diameter pipe that came into production late in 1951, has resulted in an overall bright outlook for line pipe, though the supply is far from plentiful and there is very little latitude for replacing lost production.

Heating Oil Shortages Next Winter Predicted

Several oil company executives have made public statements pointing out the possibility of shortages of heating oil next winter. George V. Holton, chairman of the board of Socony-Vacuum Oil Company, in a letter to stockholders, said that one effect of the strike was the loss of considerable heating oil production. This "could result in shortages next winter," he stated, "because, particularly in the Northeast, where there is the greatest concentration of oil burners, storage tanks must be filled during the spring and summer so we can handle the peak load demand during the heating season."

The U. S. Bureau of Mines earlier had stated that the strikes would alter the normal seasonal pattern of refinery operations during the remainder of 1952, causing crude runs close to capacity and higher current gasoline yields to make up for recent "abnormal" reductions in gasoline stocks.

Dr. Robert E. Wilson, chairman of the board of Standard Oil Company (Indiana), said in an address in Chicago that the strikes probably caused a loss in production of about 50 million barrels of oil products. "This means," he continued, "that the country has suddenly gone from an excess of around 10 million barrels of products to a deficiency of around 40 million barrels of products, nearly half of which is in gasoline.

"If we were in a free economy with free prices," he declared, "it would be much easier to take care of such dislocations.

"The present situation of product prices being frozen at levels prevailing on one particular date has largely destroyed the automatic regulatory effect of price on supply and demand," Dr. Wilson emphasized, "both as between different areas and between different products.

"Somewhat higher prices would bring into operation refineries or refinery units which cannot operate profitably under present ceiling prices. These prices have remained practically unchanged over the past 17 months, in spite of much higher labor and other costs.

"The raising of price ceilings on distillate fuels is particularly important if we are to stimulate the making of adequate heating oil supplies for next winter.

"While our crude supplies are entirely adequate," Dr. Wilson declared, "the refining division of the industry will have to operate on substantially an all-out basis to meet both gasoline and distillate fuel requirements, and even with this, there is a serious danger that distillate fuels will be short the coming winter, particularly if we are not given relief on price ceilings.

"All users would certainly be well advised to maximize their stocks before the beginning of the heating season," he advised, "and large users should increase their storage capacity."

Supply of high octane aviation gasoline almost certainly will be "on the short side" for the remainder of this year, in Dr. Wilson's opinion, although a part of the loss due to the strike was offset by the curtailed operations of airlines during May. This product has been in short supply most of the time since the start of the Korean conflict, he said, and especially so since the shutdown of the refinery at Abadan, Iran, which has shown no indications of early reopening.

Dr. Wilson estimated the loss in product production due to the strike as: (1) Gasoline production loss—"probably somewhat over 20 million barrels." (2) Kerosine and distillates production loss—"around 12 million barrels." (3) Total loss in production of products up to the end of May—"something like 50 million barrels."

"The immediate problem is gasoline," Dr. Wilson declared, "since we are now entering on the period of maximum gasoline consumption, which will mean heavy drafts on stocks between now and about October 15. . . . I anticipate that most refiners will largely concentrate on this problem for the next four months."

Increases in both refinery runs and gasoline yield per barrel of crude will be required to make up the loss in refinery production, said Dr. Wilson. Whether refinery runs can reasonably be increased more than 3 or 4 percent is a question, he stated, since refiners ran at about 94 percent of rated capacity during the first quarter and refinery runs usually decline during the summer months. "It must be remembered," he said, "that something like 10 percent of refinery capacity is either poorly located or so inefficient that it cannot today be profitably operated at present price ceilings."

The additional yield of gasoline required—45.6 percent on crude runs as compared with an average of 43.2 percent for the third quarter of 1951 —will in Dr. Wilson's opinion be possible "with the additional cracking and other facilities which have been installed in recent years."

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BETHLEHEM STEEL

AAODC Clinic Stresses Accounting Proficiency

All drilling machinery is destined to a final resting place in the junk heap—so said H. D. Edwards at the AAODC cost clinic held in Houston in June. Keynoting the cooperative and aggressive spirit seen in AAODC under the direction of President A. W. Thompson, the cost clinic was conducted for the specific purpose of prescribing a method for figuring the cost of drilling oil and gas wells. Conducted by Edwards, who is affiliated with the Arthur Young & Company of Tulsa, the Houston cost clinic represented the second session devoted to the contractor's accounting problem.

Edwards said that last years' drilling activity resulted in a $2 billion investment by the contractor and operator. The basic theme of the discussion was a comparison of the drilling contracting business to the average industrial factory. However, with the tremendous annual investment required by the drilling contractor, the drilling of oil or gas wells has become big business.

The formal and extemporaneous discussion revolved around the following three main topics:

- Elements of cost.
- Application of general principles of cost accounting.
- Cost control and statements to management.

Edwards complimented the AAODC on the service rendered through compilation and publication of accounting data in the association manuals. Furthermore, the aggressive spirit of the association and drilling industry is certainly shown by the fact that even though operating expenses increased during 1951, penetration rates also were improved.

Although repair and maintenance is of prime importance to proper rig operation, the speaker also pointed out that maintenance costs must also be watched as changing equipment and improved engineering is responsible for vast improvement in rig design. Hence, the contractor who invests large sums toward maintaining an old rig may soon find his equipment outdated by newer, improved models.

The program, though led off with formal presentation by Edwards, was informal and is expected to produce a wealth of accounting data valuable to the oil well drilling contractor. The first session was held in Dallas and it is planned to continue the program until contractors in each active drilling area have had the opportunity to participate in the plan.

Oil Policy of Ecuador Is Fair and Beneficial

Sir:

I have just finished reading your article in the WORLD OIL issue of June, 1952, titled "Danger Signs Abroad." This article, as you know, was under the international section. There is one glaring statement in this article which I would like to bring to your attention at this time. I quote the statement as follows: "Only Venezuela and Colombia of the South American nations with potential oil deposits permit relative freedom of operations."

For your information, I am president of the above company, (Manabi Exploration Company, Inc.) which, incidentally, is the only American oil company producing oil in Ecuador. I think that in the above statement you have made an unjust one as far as this country is concerned.

The Republic of Ecuador for many years has been very pro-American, and has one of the most liberal and workable petroleum laws of any Latin American country. As a matter of fact, it is much better than Colombia's or Venezuela's laws. Our company operates there in a climate of political harmony and freedom. We have a contract with the government which frees us from all foreign currency controls and changes in royalty stipulations and taxes for the next twenty years. We have taken over a British company which was losing money and have made our company pay, mainly because of the good relations between the government and our company.

CECIL HAGEN

Calgary, Alberta

•

WORLD OIL *apologizes to Ecuador and Hagen. He is right in his statement that the oil policy of the Republic of Ecuador has been a very fair and beneficial one.*

Increase in Pennsylvania Crude Output Indicated

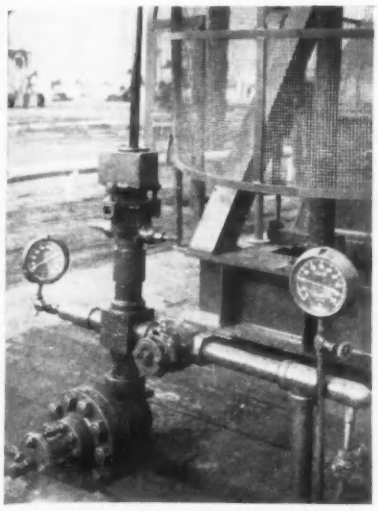
An increased supply of steel, made available by the government, and resultant greater drilling activity are encouraging with reference to the future production rate of Pennsylvania grade crude oil, although output has been less than a year ago. For the first quarter of 1952, production was 936 barrels a day less than the 1951 daily average, and for 1952 as a whole, output is expected to average from 2200 to 2700 barrels a day less than in 1951.

In the northern portion of the Pennsylvania grade region, drilling has been stepped up 64 percent in the first four months this year over the similar 1951 period, with 687 wells completed in the New York-Pennsylvania area north of Kane and Clarendon this year, against 415 a year ago.

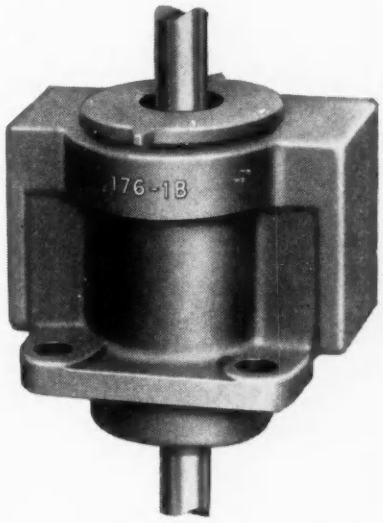
"This increase plainly indicates that the Petroleum Administration for Defense is making more steel available to producers of Pennsylvania grade crude oil," stated C. E. Streeter, of Bradford, president of the Pennsylvania Grade Crude Oil Association at the association's annual meeting in Pittsburgh early last month. The current drilling rate is equivalent to 2100 wells annually, he said, higher than in any year since 1948.

High prices paid for second hand tubular goods from oil wells hastened the abandonment of many wells in the four-state region last year, Streeter said, reducing the 1951 daily average output of Pennsylvania grade more than 500 barrels below the anticipated level. An easier steel supply and Office of Price Stabilization regulations setting maximum prices for second hand material have cut abandonments, he added.

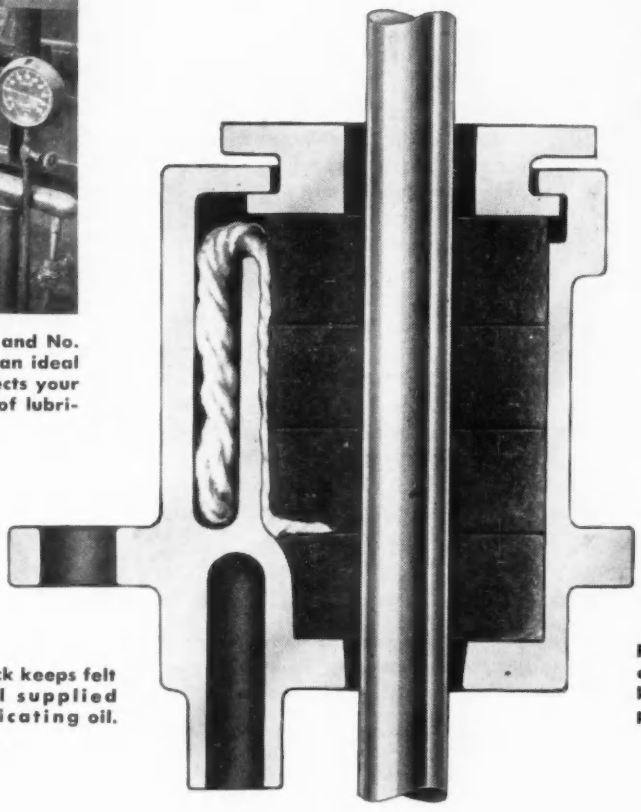
An accumulation of 890,000 barrels in above ground stocks of Pennsylvania grade crude oil since the first of this year is expected to have no weakening effect on the industry's statistical position, according to Streeter. Four refineries shut down by labor trouble accounted for a large part of the stock increase, he said. Twelve other refineries in the region were unaffected. The struck plants, now operating normally, will be enabled to maintain approximately their 1951 rate of processing as a result of the stockpiling, he predicted.



The Ratigan 176 Stuffing Box and No. 176-1B Lubricating Cap make an ideal combination that always protects your polished rod with a fine film of lubricating oil.



A Positive Safeguard For Your Polished Rod.



An 11" wick keeps felt rings well supplied with lubricating oil.

Felts hold a full pint of lubricating oil . . . keep polished rod well protected at all times.

Complete Protection and Thorough Lubrication of Polished Rod with

RATIGAN No. 176-1B LUBRICATING CAP

The Ratigan No. 176-1B Lubricating Cap is specially designed to work with Ratigan Stuffing Boxes, and provides the polished rod with continual lubrication by means of felt rings. The rings are constantly supplied with oil through a wick from the oil reservoir within the cap.

The oiling system in the No. 176-1B is distinct from that in the stuffing box. The cap requires a manual filling of the reservoir, while the stuffing box reservoir has its source from the oil in the tubing. Together they make an ideal combination . . . the lubricating cap which lubricates the polished rod when the flow of oil in the tubing is retarded, and a self-oiling stuffing box, lubricating the polished rod with oil from the well when the well is not heading. The operator who installs a Ratigan Stuffing Box, complete with Ratigan No. 176-1B Lubricating Cap, will be assured of a substantial reduction in operating expense.

When installing the No. 176-1B lubricating cap, saturate the felt rings with oil, place the wick in the oil reservoir and then in the chamber between the felts and the wall (as shown), so the wick contacts all four felt rings. When thoroughly saturated, the felts will hold the equivalent of one pint of oil and will last indefinitely, unless subject to undue abuse. The reservoir will hold an additional pint of oil and is manually filled by removing the cover of the cap. It is important to check the reservoir so that a sufficient oil supply is maintained at all times.

The Ratigan No. 176-1B Lubricating Cap complete with matching felt rings, is made for $1\frac{1}{8}$" and $1\frac{1}{4}$" polished rod and for $1\frac{1}{2}$" polished rod only. Write for complete information and prices.

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Export: National Supply Co., Inc., (Export Division) 600 5th Ave., New York 20, N. Y.

4170 Wells in May Mark Peak for '52

THE year's highest drilling rate was reached during May, when the U. S. industry completed 4170 wells to boost the five-month total into a 12.3 percent lead over last year's record-breaking operations. The month's total was substantially greater than the 3859 wells recorded in the preceding month and the previous high of 4010 credited to March.

A total of 2353 producing wells resulted from May's drilling efforts and that amounted to 59.8 percent of the total new wells drilled. A month earlier, oil, distillate and gas wells had totaled 2279 and they had accounted for a slightly better 60.1 percent of all wells. However, May's work was a bit more successful than had been efforts of a year ago, when 2108 successful wells amounted to only 58.4 percent of all new wells completed.

Through May, a total of 19,125 wells had been finaled in the U. S., and that represented a gain of 2096 wells or 12.3 percent over the 17,029 recorded in the same period of 1951. So far this year, a slightly better producing well-to-total wells drilled relationship has been maintained. In five months, 11,530 wells were completed as commercial producers and they accounted for 61.1 percent of the total new wells completed, while in last year's comparable period 10,115 producers represented 60.5 percent of the over-all.

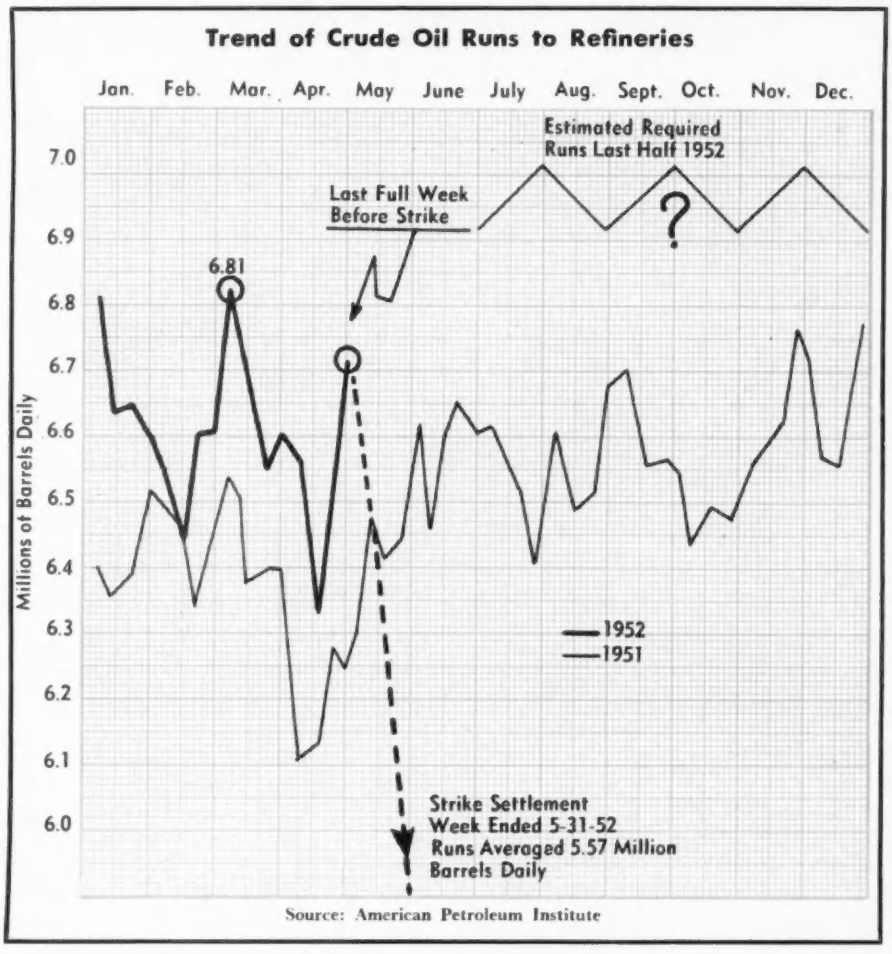
This year's advantage has been in the number of oil producers completed, while distillate and dry natural gas producers lost a little ground. To date, 10,124 oil wells have been drilled, amounting to 53.7 percent of all wells, and a year earlier 8784 oilers made up 52.5 percent.

A more impressive comparison of the two years' drilling operations is in the total amount of footage drilled. A total of 78,801,588 feet was drilled in five months of this year and that was 14,060,084 feet or 21.9 percent more than was accomplished last year. While wells themselves have been 12.3 percent more numerous, the average depth has been considerably deeper than last year's. On the average, current wells are being taken to 4164 feet and their counterparts of last year were only 3860 feet deep.

Well Completions in the United States During May, 1952, and First Five Months, 1952

(Figures compiled by WORLD OIL Staff from private reports and other sources as follows: Illinois from Illinois Geological Survey; Indiana from Indiana Division of Geology; Missouri from Missouri Geological Survey; Tennessee from Tennessee Division of Geology; Bradford, Kane-Clarendon and Allegany fields of Pennsylvania and New York from the "Producers Monthly")

State or District	MONTHLY COMPLETIONS, MAY, 1952									TOTAL COMPLETIONS				CUMULATIVE TOTALS January-May					Rigs in Operation (Drilling, Rigging-Up and Shut Down)		
	NEW WELLS								Total Drilled Deeper												
	Oil	Dist.	Gas	Dry	Water Input	Gas Input	Water Disposal	Total New		May, 1952	April, 1952	May, 1951	Footage May, 1952	Wells 1952	Wells 1951	Percent Diff.	Footage 1952	Footage 1951	May 31, 1952	April 30, 1952	May 31, 1951
Alabama	1		1	4				6		6	4	6	31,578	21	27	— 22.2	108,389	122,023	6	7	3
Arizona				1				1		1			3,544	1	2	— 50.0	3,544	3,820	3	1	2
Arkansas	16			14				30		30	37	33	98,376	154	148	+ 4.1	558,946	518,938	43	43	31
California	172		3	53				228	6	234	217	201	932,011	1,100	968	+ 13.6	4,429,978	3,678,855	244	242	247
Colorado	11		1	19				31		31	30	16	170,702	159	79	+ 101.3	864,163	377,576	38	44	27
Florida				3				3		3			15,430	4	1	+ 300.0	27,224	1,684	1	1	1
Idaho															1	— 100.0		12,844	1	1	
Illinois	66			116				182		182	124	222	459,081	649	760	— 14.6	1,589,616	1,866,401	187	178	222
Indiana	39		1	71				111		111	85	86	169,303	463	373	+ 24.1	798,672	661,877	166	158	170
Kansas	196		29	198			1	424		424	394	403	1,452,324	1,794	1,579	+ 13.6	6,208,097	5,335,375	509	485	409
Kentucky	48		16	66				130		130	85	120	266,143	453	435	+ 4.1	922,574	863,100	101	110	107
Louisiana	77	8	17	68				170	1	171	180	164	1,248,084	899	819	+ 9.8	6,185,821	5,355,435	241	240	210
North Louisiana	39	4	11	35				83	1	84	96	83	352,116	472	418	+ 12.9	1,800,203	1,607,483	61	60	72
South Louisiana	44	4	6	33				87		87	84	81	895,968	427	401	+ 6.5	4,385,618	3,747,952	180	180	138
Maryland			4	1				5		5	5	3	17,450	20	10	+ 100.0	79,865	37,002	20	19	21
Michigan	28		1	26				55	2	57	67	52	163,900	270	256	+ 5.5	734,852	648,112	95	91	111
Mississippi	6	1		23				30		30	23	38	220,801	157	122	+ 28.7	1,131,922	837,711	28	31	31
Missouri			1	3				4		4	4		3,014	14	3	+ 366.7	17,299	658	3	7	6
Montana	12		1	8				21		21	21	31	63,796	80	83	— 3.6	237,157	182,890	62	60	43
Nebraska	4		2	7				13		13	14	13	61,322	74	58	+ 27.6	368,116	265,801	13	14	10
Nevada												1			2	— 100.0		15,431	1	1	2
New Mexico	73	3	21	25				122		122	100	47	726,819	478	264	+ 81.1	2,589,991	1,219,089	180	188	114
New York	58				37			95		95	84	47	131,559	375	206	+ 82.0	522,805	291,646	117	92	57
North Dakota	9							9		9	2		90,581	17	1	+1600.0	162,464	5,609	24	17	2
Ohio	32		28	21				81	1	82	88	67	176,312	375	328	+ 14.3	811,505	660,504	163	159	156
Oklahoma	303	4	16	197	5		3	528	16	544	448	472	2,164,796	2,409	2,250	+ 7.1	8,982,699	8,061,555	595	597	604
Pennsylvania	60		22	6	53	11		152	1	153	145	131	256,718	677	554	+ 22.2	1,153,382	975,358	269	254	241
South Dakota											1			1			8,433		3	2	
Tennessee																			5	5	5
Texas	936	15	52	597	1			1,601	29	1,630	1,588	1,413	7,932,768	7,971	7,158	+ 11.4	38,190,581	30,569,991	1,720	1,724	1,679
Dist. 1 S. Central	29	1		33				63		63	54	54	178,915	290	262	+ 10.7	886,400	728,545	39	42	40
Dist. 2 Middle Gulf	24	2	11	33				70	1	71	79	63	431,753	362	313	+ 15.7	2,248,851	1,787,841	51	67	59
Dist. 3 Upper Gulf	90	6	12	82				190	1	191	148	129	1,238,173	792	609	+ 30.0	5,123,680	3,761,132	145	170	142
Dist. 4 L. Gulf-S.W.	58	5	11	58				132		132	171	128	736,573	745	650	+ 14.6	3,833,036	3,270,416	97	115	136
Dist. 5 E. Central	13		2	10				25		25	31	38	137,487	157	190	— 17.4	841,664	697,315	31	42	34
Dist. 6 Northeast	17		5	25				47		47	53	66	272,271	240	305	— 21.3	1,482,830	1,517,926	46	48	39
Dist. 7-B N. Central	117	1	6	137				261	1	262	227	228	820,353	1,181	1,060	+ 11.4	3,811,408	2,938,576	178	166	197
Dist. 7-C W. Cent.	164		1	45				210	10	220	172	111	1,208,567	998	566	+ 76.3	5,784,645	2,394,474	262	243	176
Dist. 8 West	273		2	64				339	16	355	318	301	2,027,417	1,840	1,614	+ 1.6	9,280,230	8,679,545	474	448	502
Dist. 9 North	134			103	1			238		238	281	251	779,444	1,308	1,247	+ 4.9	4,070,609	3,702,384	291	272	257
Dist. 10 Panhandle	17		2	7				26		26	54	44	101,815	258	342	— 24.6	827,228	1,091,837	106	111	97
Utah				3				3		3	5	4	13,791	25	12	+ 108.3	147,826	44,927	29	23	18
Virginia																					1
West Virginia	4		28	7				39		39	61	40	126,986	243	250	— 2.8	730,947	723,975	198	200	202
Wyoming	26	1			2			29	11	40	55	63	204,834	242	280	— 13.6	1,234,720	1,403,317	86	99	99
Total U.S.	2,177	32	244	1,537	98	11	4	4,103	67	4,170	3,859	3,673	17,202,023	19,125	17,029	+ 12.3	78,801,588	64,741,504	5,151	5,093	4,831



High Refinery Runs Needed

Plants Must Operate Near Capacity Following Strike To Build Up Product Stocks; Crude Output Adequate

By ROBERT E. SPANN
WORLD OIL Staff

DESPITE some recent indications that total demand for petroleum this year may run slightly under earlier forecasts, the industry's economic position at mid-1952 is one requiring maximum refinery runs for the remainder of the year to maintain inventories at levels in keeping with anticipated needs. At the same time no increases in crude oil production will be required in the immediate months, at least, with present above-ground stocks at excessive levels.

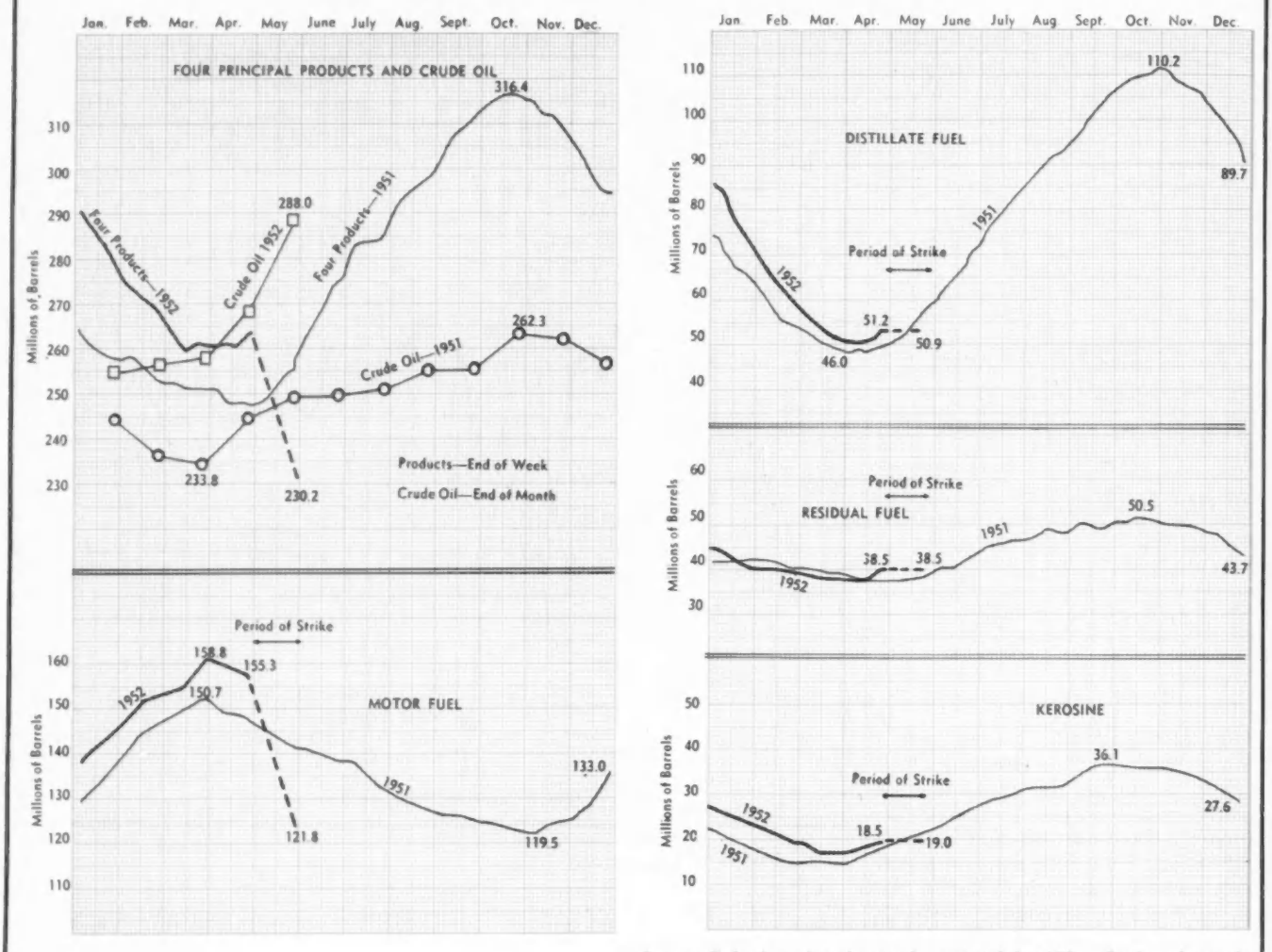
During the strike of refinery workers in May, which closed up to a third of the nation's refining capacity from two to four weeks at some plants, total inventories of the four principal refined products declined by 32½ million barrels to 230.2 million barrels. At the same time the above ground supplies of crude oil—which were more than ample at the end of April—rose another 20½ million barrels to a 14-year high of 288 million barrels at the start of June (highest since 1938). As shown on the accompanying charts, inventories of all major products, except residual fuel oil, at the start of June were below the previous year's levels. On an overall basis, product inventories at the end of the strike were 30.2 million barrels less than at the start of June, 1951, while at the end of April the total 1952 supply had been 15.7 million barrels higher than a year previous.

Industry and Petroleum Administration for Defense officials estimate the actual loss in refined products production during the period of the strike ranged from 50 million to 65 million barrels, nearly one-half of which was gasoline, one-fifth was distillate fuel oils and one-tenth was residual fuel. All estimates place two-thirds of the overall loss on the Gulf Coast, where the shutdown was of the greatest intensity.

To make up this loss, industry and PAD estimates are that refinery runs for the remainder of the year will have to be scheduled at between 6.9 and 7 million barrels daily. This rate would be close to 95 percent of the nation's estimated capacity. On the Gulf Coast the rate would have to push 97 percent of capacity, if that region is to make up its proportionate share of the products loss. The pre-strike peak runs of crude to stills reached 6.8 million barrels daily early in March, and had averaged much less than that figure in the January-April period.

While economists have some doubts for the need to make up all of this overall volume of estimated product loss, there is a real danger of a shortage of heating oil supplies for the coming winter. Yields of distillate fuels will have to be scheduled at a high level for the remainder of the year if a serious shortage—particu-

Trend of Refined Products and Crude Oil Inventories



Source: Refined product inventories reported by API, reflecting change in reporting method for 1951 figures. Crude oil inventories reported by U. S. Bureau of Mines.

larly on the East Coast—is to be averted. For stocks of the four major products to reach their 1951 peak of late October at 316.4 million barrels, a total of 86.2 million barrels of products would have to be added to the inventory position as of the start of June, 1952, and nearly 60 million barrels would have to be added to distillate fuels stock levels to match the 1951 late October-early November peak. To make allowance for the anticipated 6 percent increase in distillate fuel oil demand in the October 1952-March 1953 period, an additional 7 million-barrel distillate inventory build-up would be required, assuming only a normally cold winter. Last year's pre-heating season stocks of a little over 110 million barrels at the start of November were considered high. But an overall mild—but long—winter reduced these inventories to less than 50 million barrels by mid-April.

There is an urgent need for rapid buildup of distillate inventories. The near-whimsical approach of the OPS towards price relief to cover increased transportation charges to East Coast Suppliers offers little hope. Indications are that no price incentive for refiners to encourage higher yields can be expected before the start of the winter heating season.

The accumulation of distillate stocks prior to November will come as an incidental result of high refinery runs needed to produce gasoline to meet demand for the remainder of the peak summer consuming season.

Were the industry's economics free of unrealistic controls, refinery yields could easily be shifted to maximum distillate fuel oils output for inventory buildup and still provide enough gasoline, with some reductions in motor fuel inventories, to meet anticipated demand.

Gasoline inventories took the sharpest drop during the period of the strike, declining from an excessively high level of 155.3 million barrels at the end of April to near 122 million barrels by the end of May. This inventory level is only slightly above the 1951 low of 119.5 million barrels reached early last November. But gasoline supplies during all of 1951 were higher than necessary, and the rapid accumulation of gasoline stocks in November and December of last year—incidental to the high refinery runs required to provide distillate stocks during the winter—resulted in the extremely high pre-strike gasoline inventories in 1952. Motor fuel supplies at the end of last March had pushed to a record of 158.8 million barrels.

Refinery production of gasoline this year prior to the strike has ranged from 3 million barrels daily to 3.2 million barrels daily, and since the end of May has been within a similar range. Indicated demand for motor fuel during early June was at a rate of 3.5 million barrels daily or better, which would indicate that should this trend continue, reductions in gasoline stocks will continue. Even with a

higher seasonal gasoline demand in July and August, the June rate of refinery output would not result in any serious drain on motor fuel inventories. The present price disparity for distillate fuel oils, however, indicates some increases in refinery production of gasoline over the future with the result that the rate of withdrawal from inventories during the remainder of the summer season will be minor.

Residual fuel oil inventories at the end of May were unchanged from the pre-strike figure of 38.5 million barrels, and the trend since has been for gradual additions to stocks. Increased refinery throughput during the remainder of the year may result in a more than necessary accumulation of residual fuel supplies in storage.

While final demand figures for all oils for the first six months of the year are incomplete, the overall trend of the first quarter of 1952 indicated demand this year may not be quite as high as originally forecast. Bureau of Mines figures for the first quarter place total demand at 8,103,000 barrels daily, up 4.7 percent over the like period of 1951. This compared with the original forecast of total first quarter demand of 8,187,000 barrels daily. The month by month comparisons over a year ago, included in the first quarter total demand, showed a trend of a declining rate of increase, not indicated in the quarterly total demand figures. January demand of this year of 8,450,000 barrels daily, was up 7.4 percent over the like 1951 month; February showed a rise of 4.6 percent over a year earlier; and March demand at 7,691,000 barrels daily was only 1.9 percent over March, 1951.

Based on computations from American Petroleum Institute weekly figures, total demand in April is placed at 7,500,000 barrels daily, up about 5 percent over the similar 1951 month. No figures are available yet for May demand, due to a lack of information during the strike. The upturn in the demand trend over a year ago in April, while still below the January rate of gain, has dispelled to some extent some revised forecasts that demand for the first six months and for all of 1952 would run substantially less than expected. The sharp drop in the rate of gain in March has been generally attributed to distortions due to stockpiling by secondary suppliers in February, when a refinery strike first threatened, and a resultant decline in needs by these sources in March. Overall, however, many economists at mid-1952 estimate total demand for the year may not live up to earlier expectations, though the difference is expected to be small.

Jerry Jerome (right) of The Carter Oil Company uses marbles to explain to an employe value of company benefits.

Count Your Marbles

Company Benefits Are Explained To Workers in Simplified Terms

A SIMPLE demonstration with red, green and black marbles is used by Training Supervisor Jerry Jerome to show employes of The Carter Oil Company the value of company benefits.

Believing there can be no full appreciation without full knowledge, Jerome turns back the clock to the traditional treasures of childhood to explain the lofty legal phrases which becloud common understanding of benefit plans.

In question and answer sessions with Carter people, Jerome points to the black marbles as representing employe annuity contributions; the red ones as being company contributions; and the green as interest on both.

Then he pours all the marbles in a big glass jar until it is full. This represents the total annuity contributions until the retirement age of 65.

Next he takes three glasses, each representing a five-year period of retirement, and fills them brim full from the big glass, no marbles being left over.

Now he points out that all the black marbles, or employe contributions, bring one glass to less than half full. This means that all the money the employe has contributed is returned to him within just 18 months after his retirement. However, with the company contributions and the interest, he actually is guaranteed payments for five years, and on the average, 15 years after retirement.

It is here that Jerome scores a point which would be difficult to make with a technique less simple. What of the employe who decides to quit at 60, he asks. The amount of marbles he has in the big jar is considerably less at this stage. The employe has missed the five biggest years of green marbles (the interest) and has skipped a lot of red and black ones, too. He has less marbles to stretch over more years. The marbles barely come up halfway on each of his four glasses as compared with the three full glasses of the man who retires at 65.

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Drilling Superintendent

Mr. H. W. Cardwell
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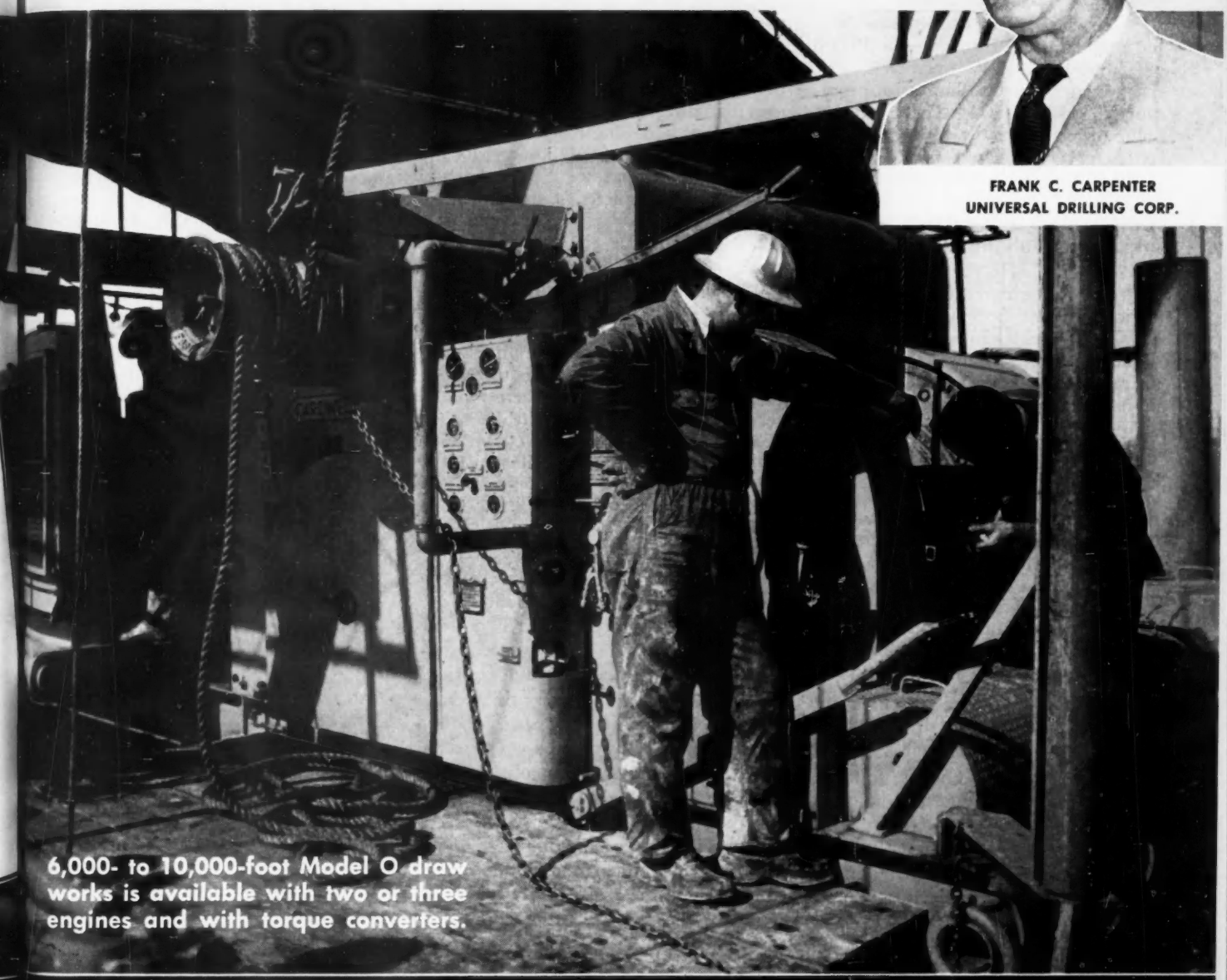

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Will the Spraberry Pay Out?

Spacing Program Clouds Picture as Economics Remains Top Question in Minds of Operators in West Texas

WHILE some parts of the Spraberry producing region are going to yield nice profits, other sectors may be hard pressed to pay out development costs on the current 40-acre spacing program. This situation is due to a great variation in probable recoveries.

Some sources fear the 40-acre spacing program will recover only 35,000 to 75,000 barrels of oil per well, with the average figure falling at approximately 50,000 barrels. At the present value of crude, gross well income will barely exceed drilling costs. Following completion the operator is then faced with day-to-day lifting costs which will soon absorb all financial surplus from all wells falling below the average.

Producing characteristics vary radically from field to field in the Spraberry trend. In some instances, 40-acre spacing likely will permit ultimate payout and profit; however, in many cases this figure cannot be seen.

Few operators are in favor of the present 40-acre spacing pattern. Some say that they cannot possibly support the financial burden of 40-acre completion practice in the less productive Spraberry horizons. In this light, there is a concerted effort toward readjustment of the 40-acre spacing requirement. In the meantime, operators are continuing Spraberry operations with respect to the following conditions:

- Offset obligations are met and inside locations are drilled to protect against drainage.
- Forty-acre spacing is followed only when the operator is forced by offset operation.
- Some fields are being drilled on the 80-acre spacing program.
- A standing agreement has been made between several operators to avoid staking locations which will force their neighbors to drill on the forty-acre pattern.

Aside from the pessimistic attitude of operators toward Spraberry locations, the present shortage of oil field tubular goods has definitely reduced the number of applications for permits. One operator has even recommended that the practice of running tubing in a well be eliminated to conserve the dwindling pipe supply.

Evaluation of the 80-acre spacing pattern is now being conducted by one Permian Basin major operator. Although the test project is relatively new, it has been found that in this spacing program, there is definite communication—indicated by interference tests—between 80-acre locations. Another operator reported that of all wells completed since the first of the year, only 8 percent remain capable of making the top allowable of 121 barrels per day. Older wells on the pump would not make top allowable after 30 days. Wells developed on the 40-acre spacing plan have a rapid rate of bottom hole pressure decline when compared to wells drilled on the 80-acre spacing pattern. Concrete evidence indicates that drainage of an 80-acre tract will be accomplished with high efficiency.

Committee Formed

Since a majority of the Spraberry operators are in favor of 80-acre spacing, a committee has been formed to develop a complete evaluation of the proposal. Interpretation of interference tests conducted by operators in the area will be given due consideration. At the same time, this committee will propose a measure for the readjustment of completed well spacement. This latter point probably will be solved by the alternate production of the upper and lower Spraberry sections in every other completed well. It has been indicated that the committee will meet the early part of July for the purpose of drafting recommendations to the Texas Railroad Commission.

Spraberry production is found over a wide area of the Permian Basin. Extending from the Germania field on the north to the Benedum field on the south, the horizon was once considered one of the most lucrative crude sources in West Texas. Extensions of the trend are found as far north as the northern part of Dawson and Borden counties. Further Spraberry production has been found in recompleted Ellenberger tests drilled in the Pegasus field.

Completion Practice Questionable

Even though the first Spraberry test was completed on the Seaboard Oil Company S. E. Lee lease in January of 1949, completion practices in the horizon have never become standardized. Due to the many pecularities of the formation, widespread existence, and tricky completion practice requirements, the policy of final well installation and technique varies from field to field as well as from one operator to another. It may be said without reservation that to date no real effective or efficient means of Spraberry completion has been discovered.

A majority of the operators are now setting pipe on top of the upper Spraberry and drilling this formation with conventional circulation using oil. In some limited instances, the completion procedure has been carried out with air circulation, horizontal drilling programs and cable tool methods.

Of course, there are limitations to open hole completion practice, especially when both the upper and lower horizon are to be exposed. When both zones are to remain uncovered, it has been found that landing casing on bottom, cementing and perforating assures a reduction of formation cycling possibilities.

A survey of completion practices indicated that of 781 wells recently drilled, 92 percent were by the open hole method while the remaining techniques ranged from casing and perforating to perforating the casing for production of the upper zone and allowing the lower horizon to remain unprotected. It is interesting to note that the average potential of the open

hole completions was 318 barrels per day while the other completion methods tested within a range from 70 to 285 barrels per day.

Production Characteristics

Not unlike the structural pattern of this peculiar formation, the performance characteristics vary radically from one extreme to another. For this reason, it is difficult to say that from the standpoint of all operations, a certain spacing pattern would be most desirable. A review of producing abilities show some offering payout possibilities on 40-acre spacing and others presenting a very pessimistic amortization picture.

From all indications, it has been well founded that well to well communication does exist with the 80-acre pattern in force. For example, an operator reported that a lease, being drilled on the 80-acre program, reflected a reservoir pressure of 2300 pounds per square inch just one year ago. Continued drilling has now uncovered the fact that newly opened wells record a bhp of 1800 psi, a pressure comparable to those recorded in the older producing wells. Hence, the rate of pressure decline must be a rather uniform phenomenon affecting the entire reservoir rather than restricted areas around the well bore.

Typical Spraberry wells show approximately the same gas-oil ratios upon completion as were recorded in the initial stages of field development. Again, some wells in the central portion of the Tex Harvey field are capable of flowing only two or three barrels of oil per day with an excessive gas-oil ratio. One well located in this area declined to a point where it was producing no gas, oil or water after making 35,000 barrels in 17 months. Case histories in other fields show producing rates of 6 to 14 barrels per day with no indication of stabilized production rates.

Bottom hole pressures and production data substantiate the theory that all fields producing from this monoclinal structure, extending from the Germania field on the north to the Benedum field on the south, produce from a common reservoir.

A case for 80-acre spacing is reflected by bottom hole pressure data collected from a widespread area. It has been found that in some areas where the 80-acre spacing program is in force, the minimum bhp decline is at a rate of 0.59 psi per day. In contrast, fields spaced on the 40-acre program have shown a decline as high as 3.86 psi per day.

Table 1 shows that a remarkably high percentage of the wells are flowing and that during April the 1602 Spraberry wells averaged 60 barrels daily. There were only 22 producing days that month, so it is immediately realized that the average yield could have been much higher. This average figure does not meet the permissible allowable of 212 barrels per day; however, many other factors possibly affected the total production. Some operators are still dependent upon tank trucks for market outlet, and this sometimes results in under production. Since April, total production data is not indicative since production was curtailed during the refinery strike.

It may be seen from the above that all Spraberry wells do not necessarily fall within the non-economical catagory. Granted, a majority offer questionable payout possibilities; however, a large number of the Spraberry producers can be inspected in a more optimistic manner. It is calculated that a Spraberry operation must have approximately 2000 barrels of producible crude available in primary recovery to show any payout possibilities. This figure is far above the previously mentioned average but there are a large percentage of producing wells which fall within this group.

TABLE 1

Production Data on Spraberry Fields
April, 1952

FIELD	Total Flowing Wells	Wells On Artificial Lift	Total Wells	Average Daily Yield Per Well
Aldwell-Spraberry	23	29	52	43
Benedum-Spraberry	76	9	85	86
Driver-Spraberry	263	22	285	71
Flat Rock-Spraberry	2	1	3	48
South Gail	....	....	....	....
North Gail	1	....	1	2
East Gail	....	1	1	47
Germania-Spraberry	54	16	70	46
Glass-Spraberry	1	4	5	11
Midkiff-Spraberry	50	13	63	74
South Midland-Spraberry	....	2	2	14
Pegasus-Spraberry	....	1	1	25
Pembrook-Spraberry	94	39	133	59
North Pembrook-Spraberry	159	36	195	69
C. Scharbauer-Spraberry	....	1	1	4
North Sawyer-Spraberry	....	....	....	....
Smith-Spraberry	....	4	4	39
Snowden-Spraberry	....	4	4	34
Spraberry Deep	19	21	40	51
Tex Harvey-Spraberry	464	35	499	50
Weddell-Spraberry	12	10	22	47
Warfield-Spraberry	....	1	1	5
Weiner-Floyd-Spraberry	121	14	135	70
Totals	1339	263	1602	60

The accepted explanation of Spraberry production mechanics revolves around the fact that initially, the crude loaded fractures and crevices permit high producing rates accompanied by high bottom hole pressure. However, as the fluids are removed from the fracture system, the production rate is retarded due to the slow bleeding of the tight, low permeability sand. The process of producing fluid from the fracture system creates a pressure differential within the void. Hence the stipulation is offered that the reservoir pressure within the tight sand section remains near the original figure but, because of the formation peculiarities, the pressurized fluid drains into the fracture system at a very slow rate.

Keeping this condition in mind, it is not difficult to imagine the outcome of pressure maintenance. By introducing pressurized gas or water to fill fracture void system, the previously created differential will tend to equalize with the sand pressure and, it is imagined, that fluid drainage will approach zero rate.

Purely of speculative nature, this theory is a sensible approach to an evaluation of Spraberry pressure maintenance projects. In short, the introduction of gas or water for the inauguration of pressure maintenance, will face the operator with greatly magnified problems and probably, little financial advantage production wise.

What Can Be Done

In summary, it may be said that there is a dire need for a thorough investigation of possibly adjusting the Spraberry spacing problem. Operators have sufficient evidence to indicate that the 80-acre spacing program will permit more interesting well amortization plus a justifiable profit. Granted, that all wells do not necessarily fall within a classification of non-commercial producers when drilled on a 40-acre basis is quite speculative.

With the advent of critical tubular goods shortages, a situation which cannot be improved in a matter of hours, days or even years, it is imperative that spacing programs be approached from not only the angle of well amortization but material conservation. If data compiled by West Texas operators is given proper evaluation, it can be seen that the possibilities of efficient 80-acre drainage offers great possibilities from the standpoint of reward to the operator, steel conservation and the proper maintenance and disposition of valuable reservoir fluid.

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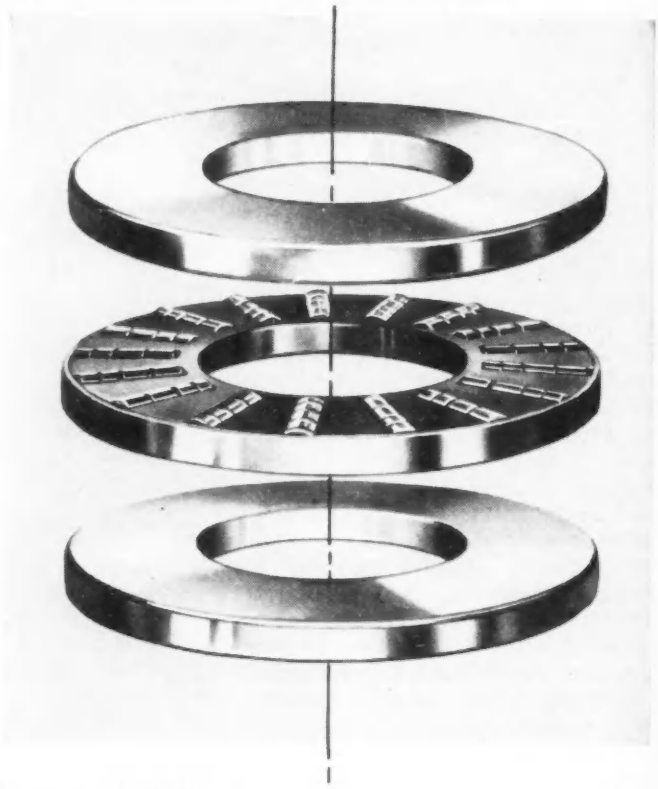

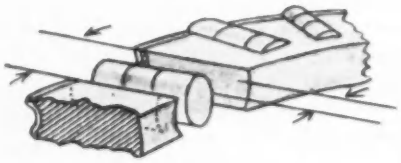

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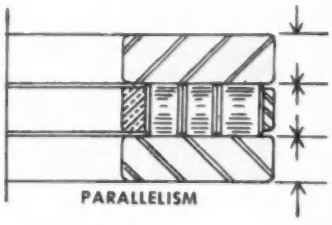

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The Accountant and Joint Ventures

Sound Accounting Methods and Procedures Are Essential In Joint Ventures Or Partnerships in Petroleum Industry

Part 1

By R. K. PEARSON
Gulf Oil Corporation, Tulsa

JOINT ventures have had their inception on bringing together in some degree (1) intangible geological data or beliefs; and (2) finances and know-how for their ultimate exploitation or development. The joint ventures may involve also those leaseholds which are too small to develop economically as individual projects. The parties interested share on some equitable basis, based on the value of their contribution, the profits or losses resulting from the venture. Many joint ventures within the industry probably started in this simple manner, but today if a definition were to be compounded, it certainly would be decidedly more complex.

This complexity must be attributed to many different and varied reasons. An important one is that in the early days of the industry, it was possible to find oil in commercial quantities at extremely shallow depths compared with today's average depths of approximately 6000 feet. By the same token, development costs were low, but sales value per barrel was at a level which made for handsome profits from each successful project. Consequently, it was a common practice to take only prospect leases with areas of 10, 20, 40, 80 or 160 acres. Such leases were taken on a checkerboard pattern, thereby insuring a profitable part in any pool, even if discovered by others. It also was the thought that by taking these smaller or protection leases, a greater area could be covered with a minimum outlay of cash for lease costs; and if subsequent offsetting discoveries were made, substantial profits could be expected from the development of even a small property. There is no question but that this type of leasing program was sound in many respects and in some degree shapes the thinking of operators today.

The deeper search and successful finding of oil and constant increase of costs along with the accurate determination of ultimate reservoir-recoveries, have revealed that these smaller leaseholds have lost considerable economical value if developed entirely individually. Consequently, in order to salvage and properly develop such acreage or leases, many operators communitize and sometimes unitize their leaseholds into joint ventures, thereby permitting their proper and profitable development. In many of these joint ventures are interest holders who individually would not have been able to develop their holdings because of the costs or because they had acquired such leaseholds for their investment value, with no intention to physically develop them. These latter owners have welcomed the joint venture operation. Well spacing orders issued and conservation statutes enacted by governmental bodies have in some instances made it mandatory for the forming of particular joint ventures.

The more common types of joint venture operation with a brief description of each are as follows:

- GEOLOGICAL. Formed for the purpose of exploring undeveloped areas. Each party shares in the information obtained, with leasing privileges as set out in the joint agreement.
- WORKING INTEREST. Pertains to the exploitation or development of leaseholds for oil and gas. Royalty interests are exempt from participation in development costs.
- NET PROFITS. Pertains to operations wherein certain interests participate only in the net profits resulting from the development, to the working interest. These interests do not think the operation has merit enough to warrant their full participation in the liabilities and hazards associated therewith.
- UNITIZATION. Pertains to operations wherein the interests have been pooled in order to permit operations as one leasehold. These may be formed voluntarily or as a result of governmental statutes. They also may be for the recovery of undeveloped primary reserves or for secondary recovery in developed area.
- FACILITY. Pertains to the forming of joint facilities necessary to the operations of several leaseholds. They in themselves are of a non-profit nature and consist of salt water disposal associations or systems, repressuring systems, fresh water and electrical systems and many more of a like nature.

In all of these types of joint ventures there is one basic fundamental requirement that each has on record an agreement or contract. With the execution of this agreement, the auditor or accounting department becomes involved, and so long as the operation is in effect, he will occupy a vital and prominent part, comparable in some degree to that to be occupied by the exploitation or producing department.

The accounting department will be charged with the responsibility of recording all revenues and expenditures thereafter, regardless if in the position of operator or non-operator. The department must require that subsequent financial reports properly contain such transactions. It must at all times be ready to prepare for management statements containing certain or particular elements of costs or revenue, bill statements rendered or received and paid, and prepare a multi-

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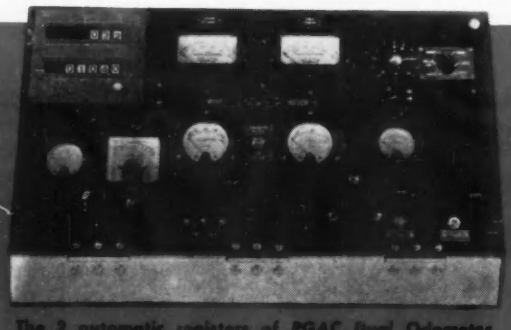

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tude of reports to various governmental agencies and bureaus.

Therefore, since the aforementioned agreement is a record that contains the stipulations that are binding upon the parties to the operation, it behooves the accountant to make every effort to see that contained therein are adequate provisions, which, if complied with, will permit the proper accounting and reporting of the operation. Management, in recognition of its demands for accounting information, should at all times permit a review by the accountant of every agreement before submitting it to the non-operator or executing it as a non-operator.

The accountant in his review should keep in mind his particular requirements and also determine if as operator his accounting system will permit his furnishing to the non-operator the accounting information as set out therein. Most agreements spell out the accounting procedure separately and attach it as an exhibit. It should contain the following provisions:

1. Billing period and date to be rendered or paid.
2. If billing is to be in detail or summary form.
3. Audit period permitted subsequent to payment.
4. Spell out types of charges to be permitted, such as labor, material, hauling, taxes, insurance, district expense, administrative overhead, etc.
5. Basis for charges for direct expenditures for material and services and also for materials and services furnished by operator.
6. Basis for credits to be passed for materials recovered by operator from the joint operation.
7. Provide for periodic inventories of joint account materials, such as warehouse stocks and lease equipment in place, and adjustment of discrepancies.
8. Provide for division in kind of surplus materials.
9. Provide for approval in advance for major expenditures; also state maximum amounts which may be expended without approvals.
10. Procedure for disbursement of oil and gas revenues.

If the foregoing provisions are recited in the agreement in a manner acceptable to the accounting, according to his requirements, he should experience no difficulties in his subsequent accounting for the operations. Recognizing the importance of these accounting procedures, and having experience with their presentation in variable forms permitting questionable interpretations, the Petroleum Accountants Society in Tulsa devised a form procedure which is revised periodically. For years operators in the Mid-Continent area have been using this as an exhibit attachment to all agreements. This has had a twofold benefit in that it has relieved management of mechanical accounting responsibilities in the preparation of agreements and has permitted the accountant's review and approval with dispatch. Standardization as reflected in a printed form accounting procedure also expedites the finalizing of periodic audits.

In order to more clearly explain the above general requirements, the accounting procedure is set forth in the following schedule:

ACCOUNTING PROCEDURE

(Unit and Joint Lease Operations)

I. General Provisions

1. Definitions. The term "joint property" as herein used shall be construed to mean the subject area covered by the agreement to which this "accounting procedure" is attached. The term "operator" as herein used shall be construed to mean the party designated to conduct the development and operation of the leased premises for the joint account.

The term "non-operator" as herein used shall be construed to mean any one or more of the non-operating parties.

2. Statements and Billings. Operator shall bill Non-Operator on or before the last day of each month for its proportionate share of costs and expenditures during the preceding month. Such bills will be accompanied by statements, reflecting the total costs and charges as set forth under Sub-Paragraph. . . . below:

A. Statement in detail of all charges and credits to the joint account.

B. Statement of all charges and credits to the joint account, summarized by appropriate classifications indicative of the nature thereof.

C. Statements, as follows:

(1) Detailed statement of material ordinarily considered controllable by operators of oil and gas properties;

(2) Statements of all other charges and credits to the joint account summarized by appropriate classifications indicative of the nature thereof; and

(3) Statement of any other receipts and credits.

3. Payments by Non-Operator. Each party shall pay its proportion of all such bills within fifteen (15) days after receipt thereof. If payment is not made within such time, the unpaid balance shall bear interest at the rate of six percent (6 percent) per annum until paid.

4. Audits: Payment of any such bills shall not prejudice the right of Non-Operator to protest or question the correctness thereof. All statements rendered to Non-Operator by Operator during any calendar year shall be conclusively presumed to be true and correct after 18 months following the close of any such calendar year, unless within said 18 months period Non-Operator takes written exception thereto and makes claim on Operator for adjustment. Failure on the part of Non-Operator to make claim on Operator for adjustment within such period shall establish the correctness thereof and preclude the filing of exceptions thereto or the making of claims for adjustment thereon. A Non-Operator, upon notice in writing to Operator and all other Non-Operators, shall have the right to audit Operator's accounts and records relating to the accounting hereunder, within 18 months next following the close of any calendar year. Non-Operator shall have six months next following the examination of the Operator's records within which to take written exception to and make any and all claims on Operator. The provisions of this paragraph shall not prevent adjustments resulting from the physical inventory of property as provided for in Section VI, Inventories, hereof.

II. Development and Operating Charges

Subject to limitations hereinafter prescribed, Operator shall charge the joint account with the following items:

1. Rentals and Royalties: Delay or other rentals, when such rentals are paid by Operator for the joint account; royalties, when not paid direct to royalty owners by the purchaser of the oil, gas, casinghead gas, or other products.

2. Labor, Transportation, and Services: Labor, transportation, and

other services necessary for the development, maintenance, and operation of the joint property. Labor shall include: (A) Operator's cost of vacation, sickness and disability benefits of employes, and expenditures or contributions imposed or assessed by governmental authority applicable to such labor, and (B) Operator's current cost of established plans for employes' group life insurance, hospitalization, pension, retirement, stock purchase, thrift, bonus, and other benefit plans of like nature, applicable to Operator's field payroll; provided that the charges under Part (B) of this paragraph shall not exceed five percent (5 percent) of the total of such labor charged to the joint account.

3. MATERIALS: Material, equipment, and supplies purchased or furnished by Operator, for use of the joint property. So far as it is reasonably practical and consistent with efficient and economical operation, only such material shall be purchased for or transferred to the joint property as required for immediate use, and the accumulation of surplus stocks shall be avoided.

4. MOVING MATERIAL TO JOINT PROPERTY: Moving material to the joint property from Vendor's or from Operator's warehouse in the district or from the other properties of Operator, but in either of the last two events no charge shall be made to the joint account for a distance greater than the distance from the nearest reliable supply store or railway receiving point where such material is available, except by special agreement with Non-Operator.

5. MOVING SURPLUS MATERIAL FROM JOINT PROPERTY: Moving surplus material from the joint property to outside vendees, if sold f.o.b. destination, or minor returns to Operator's warehouse or other storage point. No charge shall be made to the joint account for moving major surplus material to Operator's warehouse or other storage point for a distance greater than the distance to the nearest reliable supply store or railway receiving point, except by special agreement with Non-Operator; and no charge shall be made to the joint account for moving material to other properties belonging to Operator; except by special agreement with Non-Operator.

6. USE OF OPERATOR'S EQUIPMENT AND FACILITIES: Use of and service by Operator's exclusively owned equipment and facilities as provided in Paragraph 4, of Section III, "Basis of Charges to Joint Account."

7. DAMAGES AND LOSSES: Damages or losses incurred by fire, flood, storm, or any other cause not controllable by Operator through the exercise of reasonable diligence. Operator shall furnish Non-Operator written notice of damage or losses incurred by fire, storm, flood, or other natural or accidental causes as soon as practicable after report of the same has been received by Operator.

8. LITIGATION, JUDGMENTS, AND CLAIMS: All costs and expenses of litigation, or legal services otherwise necessary or expedient for the protection of the joint interests, including attorney's fees and expenses as hereinafter provided, together with all judgments obtained against the joint account or the subject matter of this agreement; actual expenses incurred by any party or parties hereto in securing evidence for the purpose of defending against any action or claim prosecuted or urged against the joint account or the subject matter of this agreement.

A. If a majority of the interests hereunder shall so agree, actions or claims affecting the joint interests hereunder may be handled by the legal staff of one or more of the parties hereto, and a charge commensurate with the services rendered may be made against the joint account, but no such charge shall be made until approved by the legal department of or attorneys for the respective parties hereto.

B. Fees and expenses of outside attorneys shall not be charged to the joint account unless authorized by the majority of the interests hereunder.

9. TAXES: All taxes of every kind and nature assessed upon or in connection with the properties which are the subject of this agreement, the production therefrom or the operation thereof, and which taxes have been paid by the Operator for the benefit of the parties hereto.

10. INSURANCE:

A. Premiums paid for insurance carried for the benefit of the joint account, together with all expenditures incurred and paid in settlement of any and all losses, claims, damages, judgments, and other expenses, including legal services, not recovered from insurance carrier.

B. If no insurance is required to be carried, all actual expenditures incurred and paid by Operator in settlement of any and all losses, claims, damages, judgments, and any other expenses, including legal services, shall be charged to the joint account.

11. DISTRICT AND CAMP EXPENSE: A proportionate share of the salaries and expenses of Operator's district superintendent and other general district or field employes serving the joint property, whose time is not allocated direct to the joint property, and a proportionate share of maintaining and operating a district office and all necessary camps, including housing facilities for employes if necessary, in conducting the operations on the joint property and other leases owned and operated by Operator in the same locality. The expense of, less any revenue from, these facilities shall include depreciation or a fair monthly rental in lieu of depreciation on the investment. Such charges shall be apportioned to all leases served on some equitable basis consistent with operator's accounting practice.

12. OVERHEAD: Overhead charges, which shall be in lieu of any charges for any part of the compensation or salaries paid to managing officers and employes of Operator, including the division superintendent, the entire staff and expenses of the division office located at . . . . . , and any portion of the office expense of the principal business office located at . . . . . , but which are not in lieu of district or field office expenses incurred in operating any such properties, or any other expenses of Operator incurred in the development and operation of said properties; and Operator shall have the right to assess against the joint property covered hereby the following overhead charges:

A. $. . . . . per month for each drilling well, beginning on the date the well is spudded and terminating when it is on production or is plugged as the case may be, except that no charge shall be made during the suspension of drilling operations for fifteen (15) or more consecutive days.

B. $. . . . . per well per month for the first five (5) producing wells.

C. $. . . . . per well per month for the second five (5) producing wells.

D. $. . . . . per well per mont for all producing wells over ten (10).

E. In connection with overhead

• CONTINUED ON PAGE 58

Tight Supply Ahead In California

West Coast Production Is Expected to Fall Short of Sharply Increasing Demand Within Next Several Years

By GILBERT M. WILSON
WORLD OIL Staff

CRUDE oil supply in California while generally adequate now except for certain product shortages caused by the Korean war, ultimately will fall short of rapidly increasing demand. Possibly within the next several years. This sums up opinions expressed recently by leaders and recognized authorities of some principal West Coast operating companies.

Because it is an isolated province having its own production and its own marketing area, California long has been known as an area of surplus, except during war time. The area now is at a point, according to Robert L. Minckler, president of General Petroleum Corporation, where this surplus situation no longer will prevail.

Speaking recently before a meeting of the National Federation of Financial Analysts Societies in San Francisco, Minckler expressed the opinion that the West Coast oil industry is in the process of changing first from an economy of surplus to one of balance, then to one of shortage. "It seems apparent," said Minckler, "that the present productive capacity of California oil wells is some 75,000 to 85,000 barrels per day in excess of normal demand in natural markets. This is not much fat, but it certainly does not indicate an immediately critical short condition."

1955 Danger Period

He pointed out that in a general way the area probably will be in balance, with no surplus and with no shortage, for the next two or three years. From about 1955 on, however, he saw a period of conflicting trends of future demands. Increasing the demand will be such factors as a steadily increasing population on the West Coast, with more automobiles to fuel with gasoline; more homes to heat with burning oils and more steam-electric generating equipment using heavy fuel oil. Tending to decrease demand will be the continued conversion of locomotives from steam to diesel; loss of some ship bunkering business; and displacement of some fuel oil by the building of new natural gas lines into the area. He estimated that 1955 would be the year in which the area would see an overall shortage of local crude oil production.

Plans for Future

Lest someone should construe his remarks as indicating that an oil shortage would exist in the West, Minckler pointed out that Pacific Coast oil companies will take whatever steps become necessary to assure a continued supply of petroleum products. He noted, for example, that the Trans Mountain Oil Pipe Line, bringing crude from Alberta to British Columbia, and having an ultimate capacity of some 200,000 barrels per day, presently is under construction and will be completed by 1954. An oil refining industry will be developed in the Pacific Northwest if and when Canadian oil becomes an important source of supply to the West Coast, Minckler said. Taking a dim view of the proposed movement of West Texas crude oil to California, Minckler expressed the belief that when it is compared with the movement of Canadian oil to the Pacific Northwest, logistics favor the Canadian movement by a wide margin.

Other potential sources of supply, the General Petroleum executive said, may lie in the Uinta Basin of eastern Utah; the four-state San Juan Basin area; also the western part of the Rocky Mountain region and eastern Nevada.

Standard Oil Company of California, in its 1952 first quarter report, through its board chairman, R. G. Follis, had this to say about the West Coast supply-demand situation: "The West Coast still is in a tight supply situation, and with the forthcoming summer demands for gasoline, this will continue." The company reported to its stockholders that, to meet essential requirements, it had been importing supplemental crude oil from Borneo and, in May of this year, would start shipments from company affiliates in Sumatra.

Inventories Reduced

At the annual meeting of stockholders of Union Oil Company of California in April, Reese Taylor, president, placed further emphasis on not only the present, but the probable future shortages in supply. He said that the failure of total petroleum supply to keep pace with rising demand last year was of major concern to the Pacific Coast petroleum industry. "This failure," Taylor warned, "occurred despite the industry's sharply accelerated drilling and producing operations and increased importations of crude oil and refined products at high cost." The steady withdrawal from inventories caused by this failure to keep up with demand, he said, has resulted in reduction of inventories to uneconomically low levels.

Taylor pointed out that increase in demand by the military has somewhat

accelerated and exaggerated the total Pacific Coast demand picture, but declared that it is not a temporary phenomenon attributable solely to this factor. "This increase in total petroleum demand," he said, "is due primarily to such permanent factors as the great increase in the population of the Pacific Coast states and the establishment and growth of great industries in the area. These growth factors are not declining, but continuing."

Demand Increases

Taylor cited statistics showing that during the period 1941 to 1951 alone, total petroleum demand in the Pacific Coast area increased 61 percent. "We believe it a conservative estimate to say," he declared, "that by 1960, total petroleum demand on the Pacific Coast will reach a level of 1,300,000 barrels per day, compared with a 1951 level of about 1,125,000 barrels per day."

In earlier statements, the company expressed the view that much of the blame for California's failure to keep pace with demand could be blamed on unrealistic price ceilings on crude oil, which had discouraged the development of high cost production on the Pacific Coast. On March 25, the company formally filed application with the Office of Price Stabilization for an average increase in the price of California crude oil amounting to 60 cents per barrel. At that time, Taylor issued a statement saying in part, that "unless additional discoveries are forthcoming in the area, the production of crude oil shortly will be insufficient to meet even normal civilian demand, much less possible military requirements. The situation can best be alleviated by the drilling of more wells and the increase of marginal production. The necessary incentive can be supplied only through an immediate and much needed increase in the ceiling price for California crude petroleum and petroleum products." (The application for higher ceilings was denied by OPS in a letter order of May 9.)

Consumption Increase Due

Looking at the more immediate trend on the Pacific Coast, V. A. Bellman, vice president and director of marketing of General Petroleum Corporation, said it is expected that the public of western states will consume about 4 percent more gasoline in 1952 than in 1951. Addressing the North American Gasoline Tax Conference (Pacific Region) at Phoenix, Ariz., in May, Bellman said, in speaking of a probable 3 to 5 percent increase in gasoline demand, "there is no doubt that the trend is up, and in the opinion of oil economists, this trend will hold whether general business conditions are good, bad or indifferent." Since this demand is compounded annually, Bellman said, this average annual increase of 4 percent amounts to nearly a 50 percent increase in 10 years.

Bringing into focus the rapidly declining stocks of heavy oil in California, a committee of California independent oil producers recently filed a formal application with the Office of Price Stabilization requesting adjustments in the heavier grades of crude, ranging from an increase of 70 cents per barrel for 10 gravity, down to 3 cents per barrel for 31 gravity. The application included data which pointed to the correlation between the price of heavy crude and the rate of development of fields which produce heavy crude. Reviewing the situation leading up to the present inequitable price relationship, the applicants pointed out that during the latter months of 1948 and through 1949, a temporary surplus of heavy crude had been built up. In 1949, heavy-crude prices were slashed by all purchasing companies, but they had begun to recover during the last half of 1950, only to be frozen before normal relationships in supply and demand had been reestablished. Stocks of heavy fuel, which were at 40,440,000 barrels on September 30, 1949, had fallen to 17,107,000 barrels by the end of 1950, to only 13,357,000 barrels by the end of 1951, and to 11,845,000 barrels by May 31, 1952.

In asking for the price ceiling adjustments, the applicants said: "Such price ceiling adjustments would be greatest for those crude oils where the need therefor is greatest, but necessarily extend, on a decreasing scale, into the lighter grades of crude petroleum, because they also contain heavy components in decreasing proportions." Declaring that the shortage in heavy fuel had developed because of prevailing price ceiling, the application concluded, "an adjustment of heavy crude petroleum prices ceilings in California to provide economic incentive to augment production would be a precise application of the intent expressed in the (Defense Production) Act."

The Accountant

• CONTINUED FROM PAGE 56

charges, the status of wells shall be as follows:

(1) Input or key wells shall be included in overhead schedule the same as producing oil wells.

(2) Producing gas wells shall be included in overhead schedule the same as producing oil wells.

(3) Wells permanently shut down, but on which plugging operations are deferred, shall be dropped from overhead schedule at the time the shutdown is effected. When such wells are plugged, overhead shall be charged at the producing well rate during the time required for the plugging operation.

(4) Wells being plugged back or drilled deeper shall be included in overhead schedule the same as drilling wells.

(5) Various wells may be shut down temporarily and later replaced on production. If and when a well is shut down (other than for proration) and not produced or worked upon for a period of a full calendar month, it shall not be included in the overhead schedule for such month.

(6) Salt water disposal wells shall not be included in overhead schedule.

F. The above overhead schedule on producing wells shall be applied to individual leases; provided that, whenever leases covered by this agreement are operated as a unitized project in the interest of economic development, the schedule shall be applied to the total number of wells, irrespective of individual leases.

G. The above specific overhead rates may be amended from time to time by agreement between Operator and Non-Operator if, in practice, they are found to be insufficient or excessive.

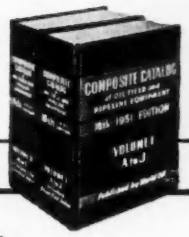
13. WAREHOUSE HANDLING CHARGES:

14. OTHER EXPENDITURES: Any other expenditure incurred by Operator for the necessary and proper development, maintenance, and operation of the joint property.

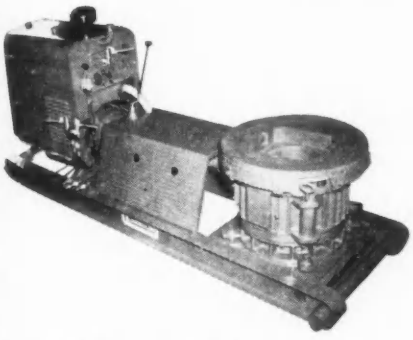
(First of Two Parts)

NEW AND IMPROVED EQUIPMENT

SUPPLEMENTING COMPOSITE CATALOG



KEEP INFORMED by requesting additional information on new equipment and services described on this and following pages. SAVE TIME by using one of the free and convenient Reader Service Postcards on opposite page. Circle number on card corresponding to the number listed at the end of each new equipment item on which you desire additional information.



Skid Rotary Unit

This item supplements Franks Manufacturing Corporation data on pages 1801-1804 of Composite Catalog, 18th Edition.

A new packaged "Fluid Drive" skid rotary unit designed to fit any rig is made by Franks Manufacturing Corporation. The 12 x 4-foot unit weighs less than 6000 pounds. The Franks Model 9428 Rotary table is of the direct drive type, which eliminates the need for a reverse gear box. The table is driven by a 70-horsepower automotive engine through an automotive transmission. The engine and transmission are linked to the table by a fluid coupling which helps eliminate the shock load on the drill pipe. The engine has a spark arrester. Either manual or air controls are available.

Circle No. 14 on Postcard

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Filtration System

This item supplements Hercules Filter Corporation data on page 2245 of Composite Catalog, 18th Edition.

A new miniature pressure leaf filter makes it possible to check the efficiency of a type of liquid filtration equipment before buying the full-scale production model. The miniature filter duplicates the features of production filters exactly, even to pump, pre-coat mixing tanks, and quick opening door. To try out the small-scale model, some of the material to be filtered is mixed with the filter aid in the pre-coat tank of the test filter. The operator then coats the filter leaves, and then starts the flow of material to be filtered and runs it for a full cycle. He can either draw the product to be filtered directly from a tank, or can "cut" the test filter into a bypass on the main line. The pre-coat tank in the meantime functions as a slurry tank feeding additional filter media to the filter. All processes of filtration, including the selection of filter media, can be studied and determined accurately.

Circle No. 15 on Postcard

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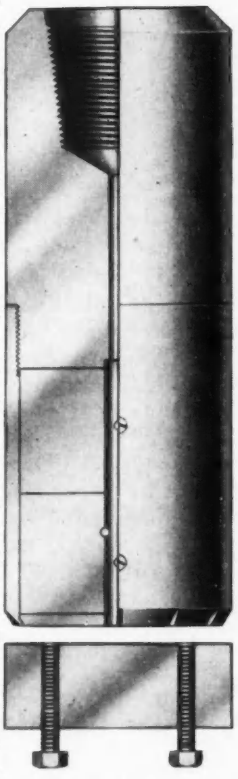
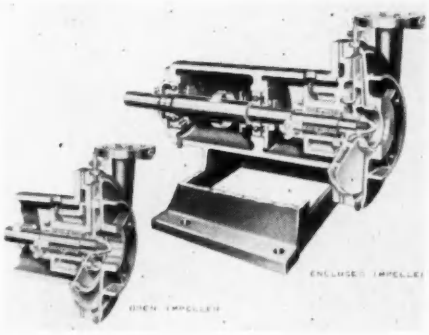
Fishing Magnet

This item supplements S., R. Bowen Company data on pages 781-820 of Composite Catalog, 18th Edition.



The Bowen Kingston Fishing Magnet, available from S. R. Bowen Company, retrieves all types of small objects having magnetic attraction, such as bit cones, slips, milling cuttings, tong pins, hammers, etc. The tool consists essentially of a body, a nonmagnetic stainless steel sleeve, and permanent magnets. There are no moving parts. The plate protects the magnets from any damage that might result from physical contacts. All sizes are provided with a circulating hole large enough for standard purposes. Power of the fishing magnet is concentrated at its engaging end. With proper care, it is claimed that the life of the magnets can be prolonged indefinitely. The tools can be run on either wire line or pipe.

Circle No. 16 on Postcard



Chemical Pump

This item supplements Peerless Pump Division, Food Machinery and Chemical Corporation data on page 4165 of Composite Catalog, 18th Edition.

For pumping almost all process liquids, either hot or cold, in moderate capacities against low, medium or high heads, with emphasis on corrosive and abrasive liquids with solids in suspension up to 5 percent by volume, Peerless Pump Division has introduced a new chemical process pump, Type DS. It is available in discharge sizes from one inch through six inches, with either enclosed or open impeller. Both grease- and oil-lubricated models are offered.

Circle No. 17 on Postcard

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Single Stage Pump

This item supplements Ingersoll-Rand Company data on pages 2485-2492 of Composite Catalog, 18th Edition.

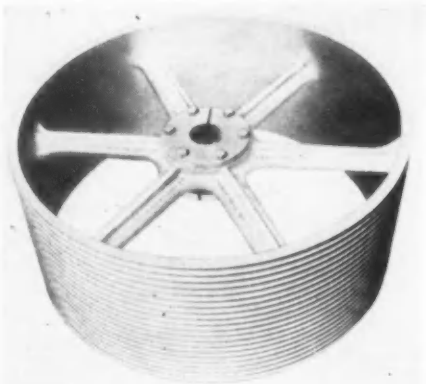
Ingersoll-Rand Company's small, single-stage, double-suction pumps, Class DMV-DHV, now have double mechanical shaft seals with sealed, pre-lubricated ball bearings. The totally enclosed pumping unit is built in 3-, 4-, 5- and 6-inch sizes. The DMV (for medium heads) and DHV (for high heads) are designed for general hydraulic services at temperatures up to 200°F., capacities to 2100 gallons per minute, and pressures to 150 pounds per square inch. The double-shaft-seal prevents air leakage into the pump when it is operating under suction lift.

Circle No. 18 on Postcard

NEW EQUIPMENT

SUPPLEMENTING COMPOSITE CATALOG

To obtain additional information use convenient Reader Service Postcard on page 61. Circle number on card corresponding to number listed at the end of each new equipment item on which more information is wanted.



V-Belt Pulley

This item supplements Wichita Falls Foundry & Machine Company data on pages 5094-5097 of Composite Catalog, 18th Edition.

V-belt pulleys are now available in any size up to 70-inch pitch diameter and 36-inch face, for any standard belt size, Wichita Falls Foundry & Machine Company announced. Many sizes have the split-type removable hub which can be bored and keywayed to any desired size. This hub is firmly bolted to both sides of the pulley hub to provide rigidity and strength of a solid hub, with easy removal from shaft and change of bore.

Circle No. 19 on Postcard

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Engine Starters

This item supplements United Supply & Manufacturing Company data on page 4959 of Composite Catalog, 18th Edition.

The Single-Cylinder engine starter made by United Supply & Manufacturing Company gives positive pressure and continuous cranking power for starting single cylinder engines. This unit removes hazards of starting engines—it is foot operated leaving the operator's hands free. Positive power is obtained from the gasoline engine. Positive friction is controlled by operator to give extra power when needed. Sizes range from 5 to 90 horsepower.

Circle No. 20 on Postcard

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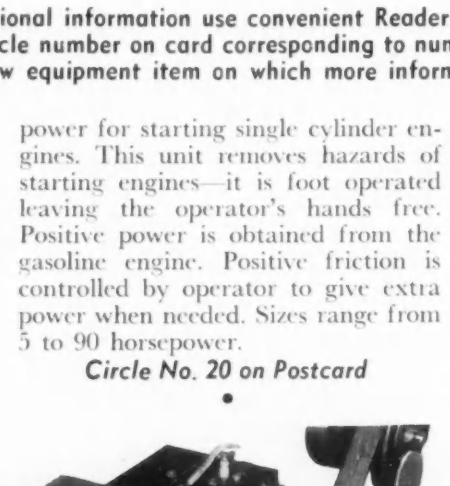

United Supply & Manufacturing Company's Multi-Cylinder engine starter provides continuous cranking power from an easily started gasoline engine. This unit has a Bendix drive that operates off ring gear, and does away with batteries, generators and electric starters. Only one hand is required to operate the starter, leaving the other hand free to adjust the engine. To install, the electric starting motor is removed and heavy-duty Bendix starter drive assembly is installed.

Circle No. 21 on Postcard

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Overload Release

This item supplements Dodge Manufacturing Corporation data on pages 1431-1434 of Composite Catalog, 18th Edition.

The Tri-Matic overload release for the Dodge Torque-Arm Speed Reducer provides positive protection for driven machines, motors and the speed reducer itself, according to Dodge Manufacturing Corporation. The release operates both mechanically and electrically to loosen the belts, cut off the current, and activate a warning bell, siren or light. Pressure exerted by an excessive load causes a piston to move lengthwise through the unit and this movement loosens the belts and cuts off the current simultaneously. The warning system is hooked up to the micro switch. The release is calibrated for adjustment to load conditions.

Circle No. 22 on Postcard

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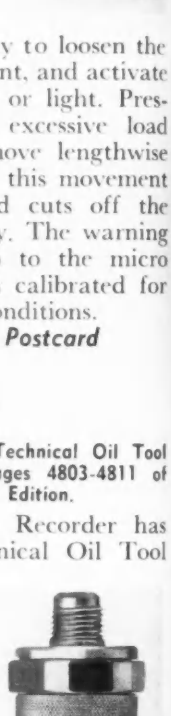
Double Recorder

This item supplements Technical Oil Tool Corporation data on pages 4803-4811 of Composite Catalog, 18th Edition.

The Totco Double Recorder has been added to Technical Oil Tool Corporation's line of inclination recording equipment used in controlled vertical drilling. The positive, self-checking, mechanical drift indicator produces two records of the hole's inclination on each run of the instrument, to provide a check of accuracy. As in the earlier model, the new tool consists of the recording instrument and the go-devil in which the instrument is run. There has been no change in design of the go-devil. The new double-recording instrument has two parts, the angle indicator and the recording element, both completely enclosed and sealed. The entire recording procedure is accomplished in less than 30 seconds.



Circle No. 23 on Postcard

OTHER NEW AND IMPROVED EQUIPMENT

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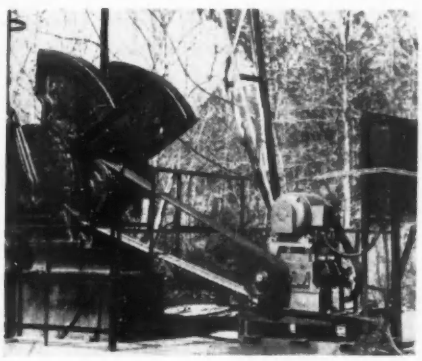
Transmission

Turner Machinery Company's Multi-Speed Transmission enables oil field operators to change the strokes-per-minute of their pumping equipment. In most cases, the four speeds available in the Turner transmission make possible utilizing the maximum range and capacities of existing oil



field equipment. Where special speeds are needed, three, six and nine-speed transmissions are available. Sizes range from 1 to 60 horsepower. The transmission can be used in many oil field operations, such as well testing to determine most efficient pumping speed; testing wells on a water flood; pumping off water wells; "bumping bottom" where gas lock occurs; and correcting rod breakage on deep wells by pumping at speeds unavailable by conventional means.

Circle No. 24 on Postcard

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Hard-Facing Rod

Mir-O-Col Alloy Company, Inc., is producing a new hard-facing welding rod, No. 7, for manual electric (ac-dc) application. The rod is especially suited for oil field applications requiring high resistance to heavy impact, severe abrasion and shock. It can be used to reclaim tool joints, churn drill bits, clutch jaws, fishtail and cable tool drill bits, impeller tips, kelly bushings, pump shafts and sleeves, twinpins, etc. No. 7 is a cast alloy rod containing chromium, nickel, iron and other alloys. Hardness of deposit is from 54 to 57 Rockwell C.

Circle No. 25 on Postcard

Electrode Holder

The Model A-732 Twecotong Holder is a lightweight, 300 ampere electrode holder made by Tweco Products Company. It has a lightweight, high copper alloy for maximum conductivity. Raised upper lever allows plenty of room for the operator's hand when a welding rod is in the jaws of the holder. Body and tip ends of the holder are insulated with "Super-Mel" insulators, and tip end insulators are interchangeable. The A-732 will handle from 7/32 through 1/16 inch electrodes. Welding cable may be soldered or clamped mechanically to the body.

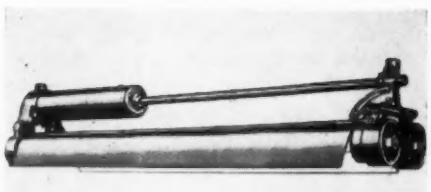
Circle No. 26 on Postcard

•

Explosion-Proof Light

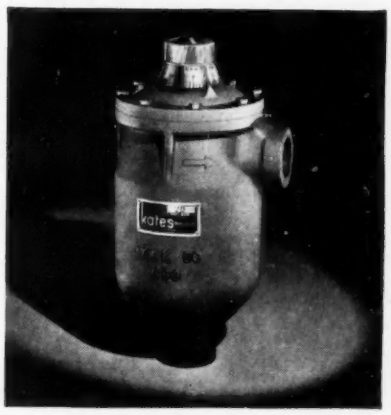
Crouse-Hinds Company's new series type EVF explosion-proof lighting fixtures enclose 36-watt, 48-inch T-12 Slimline lamps. The fixtures find especial application in possibly explosive locations, such as pipe line pump and compressor stations. The fixtures consist of two, three, or four lamp enclosing tubes of Pyrex sealed into cast aluminum end fittings containing the sockets. A cast aluminum ballast housing is mounted above the lamp tubes. Sheet aluminum reflectors are between the lamp tubes and ballast housing. Re-lamping end of the fixture has a toggle arrangement which permits dropping the end of the tube sufficiently to clear an adjacent fixture. Thus the fixtures may be mounted end-to-end.

Circle No. 27 on Postcard



Flow Rate Regulator

Modifications in the direct-acting flow rate regulator manufactured by W. A. Kates Company adapt it to such jobs as blending and proportioning, solvent extraction, controlling filter effluent, water treatment and deionizing, diluting of bulk heavy chemicals, and other jobs. The regu-



lator automatically holds flow to the rate set on the calibrated dial, despite pressure fluctuations in either the inlet or outlet lines. The regulator is available in capacities from 0.1 to 100 gallons per minute of water.

Circle No. 28 on Postcard

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Roller Chain

Whitney Chain Company has introduced a roller chain incorporating oil-impregnated sintered metal bushings. Requiring little or no lubrication, the new chain drive is said to operate efficiently where conventional lubrication methods are either not possible or desirable. In Tests, a 5/8-inch pitch oil-impregnated Sintered Bushing Chain and a 5/8-inch pitch prelubricated standard roller chain were installed on 19-tooth and 45-tooth sprockets having a center distance of 8.75 inches. The two chains were then run under a 10 horsepower load at 1900 revolutions per minute. At the end of 20 hours operation, the standard chain showed wear or elongation of .380 inch, while the oil-impregnated Sintered Bushing Chain showed a wear or elongation of but .080 inch.

Circle No. 29 on Postcard

To obtain additional information use convenient Reader Service Postcard on page 61. Circle number on card corresponding to number listed at the end of each new equipment item on which more information is wanted.

Flow Receiver

The ElectroniK inductance bridge receiver combines in a single instrument a number of functions which formerly required the use of two instruments, according to Minneapolis-Honeywell Regulator Company. The receiver makes it possible to indicate, record, integrate and control flow and liquid level. Data can also be retransmitted pneumatically to a second receiver remotely located. An Indexet mechanism is available to reset the control index from a remotely located transmitter.

Circle No. 30 on Postcard

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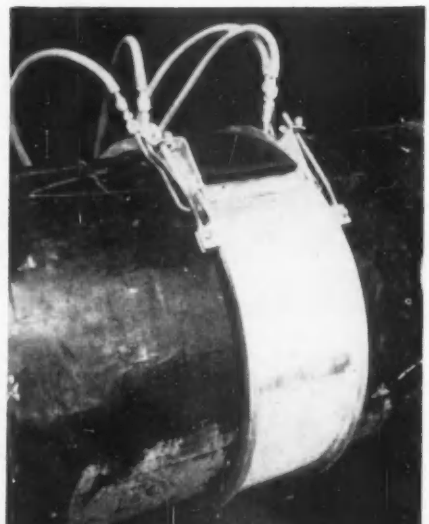
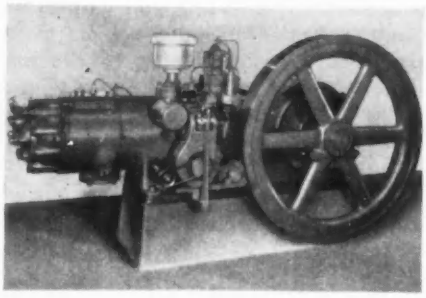


Inspection Technique

The McElroy-McNutt hot radiography process, a technique which permits taking X-ray photographs of large pipes, valves and similar units at temperatures as high as 1200°F., has been announced by Sam Tour & Company, Inc. Hot radiography makes it possible to interrupt the welding operation to inspect the weld root where most flaws occur. It saves the man-hours of heating and controlled cooling that formerly were required before the weld could be inspected by the radiography process. Additional time may be saved because, if defects are found, it is necessary to chip away only a partially-completed weld, rather than a finished weld.

Circle No. 31 on Postcard



Horizontal Diesel

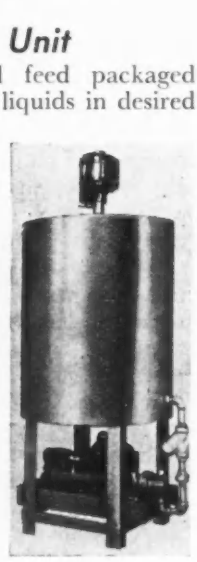
The Lorain Model DA is a new horizontal type single-cylinder, two-cycle diesel engine developed by White-Roth Machine Corporation. It has a 13-inch bore and stroke and continuous rating of 55 brake horsepower at 325 revolutions per minute. Tapered roller bearings are used for crankshaft and auxiliary shafts, and the wet sleeve cylinder liner is of alloy cast iron. The engine can be operated as a cold-starting full diesel, or can be converted in the field to burn natural gas or butane. A Pickering governor, Air Maze oil-bath cleaner, McCord lubricator, and built-in 7¼ horsepower Lorain gasoline starter are standard equipment.

Circle No. 32 on Postcard

•

Chemical Feed Unit

A new chemical feed packaged unit which delivers liquids in desired amounts under pressure was announced by The Bird-Archer Company. Chemical reservoir tank is of welded steel construction, available in 50 or 100 gallons capacity. The chemical proportioning pump can be designed for various rates of feed at different pressures. A motor-driven agitator mixes fluids, and a stainless steel strainer is provided between the suction side of the pump and the tank. The pump is mounted below the tank to minimize air binding and to maintain a positive suction head. A duplex-pump model with divided tank is also available.



Circle No. 33 on Postcard

Torque Converters

Factory-installed torque converters can now be provided for six sizes of industrial engines by Caterpillar Tractor Company. On heavy and varying loads, torque converters allow the diesel engines to maintain a continuously high output. Turning effort is multiplied considerably at low output speeds. When loads are lifted or lowered, the converter facilitates the "pick up" of a standing load or the braking of a load being lowered. Cat diesel engines available with torque converters range from 70 to 500 brake horsepower. Torque converters are Twin Disc models that use ordinary diesel fuel as hydraulic fluid, making it possible to attach a charging device that draws from the engine fuel supply. An independent cooling system is also offered.

Circle No. 34 on Postcard

•

Chain Hoist

A push button control model has been added to the line of Comet Electric Chain Hoists made by Chisholm-Moore Hoist Corporation. Available in capacities from 250 to 2000 pounds, the new model operates from any single phase lighting circuit, 220 or 440 volt power line, but no more than 110 volts pass through the control station. The hoist has "Herc-Alloy" Double Duty flexible welded steel load chain, helical gears, positive chain guide, precision bearings, fully enclosed mechanism, and permanent lubrication.

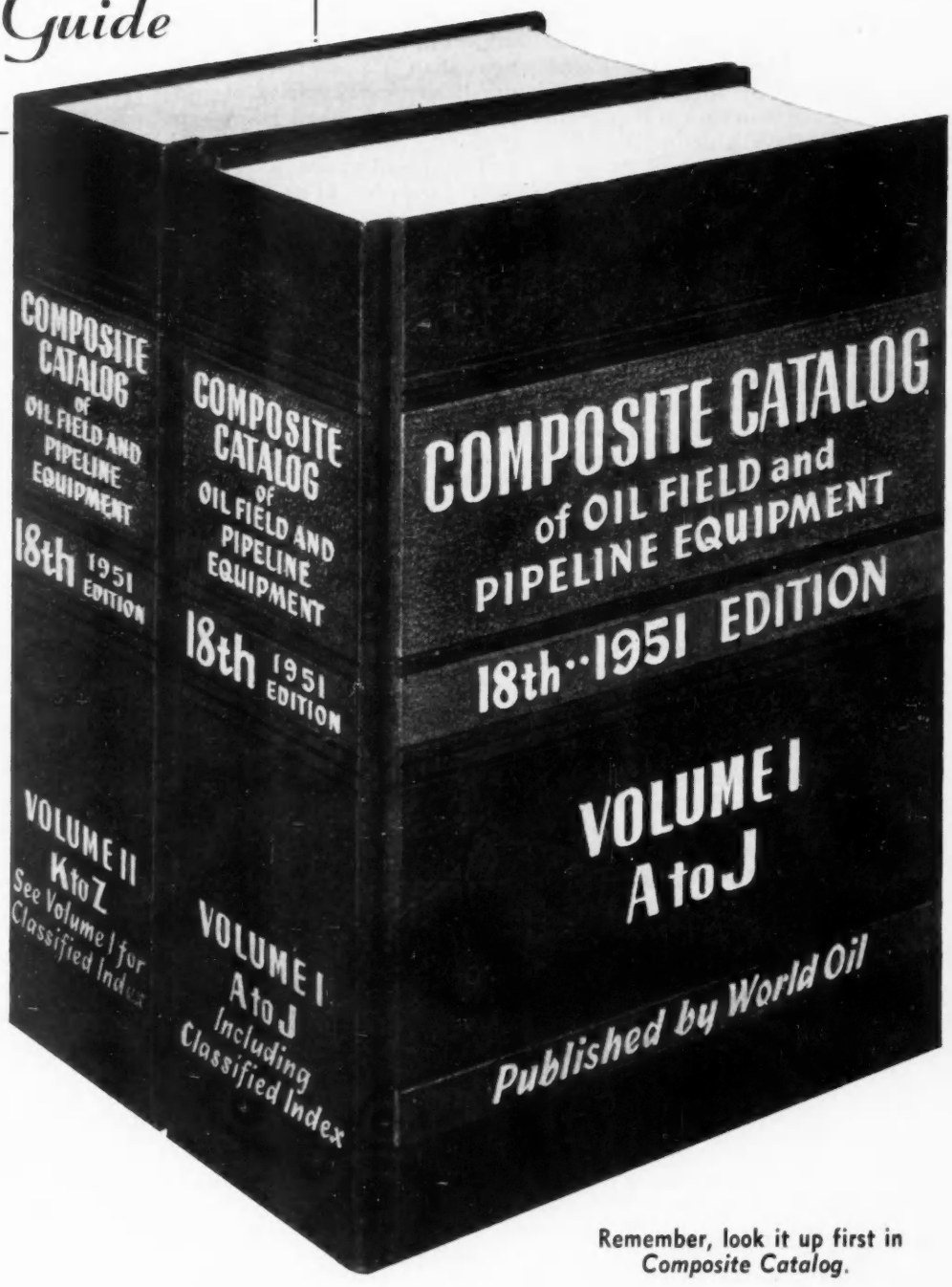
Circle No. 35 on Postcard

For over 22 years—

THE UNIVERSAL OIL COUNTRY *Buyers' Guide*

For two decades, *Composite Catalog* has been the very "equipment bible" of oil field buyers. Indexed by both company and product name, the current 5,000-page edition is made up of the combined catalogs of 500 manufacturers having a common market in the oil producing and pipe line industry.

Wherever oil is produced or sought, this catalog is accepted as the standard source of buying information. You will save time and avoid errors by identifying the equipment as per page and figure numbers in *Composite Catalog*.



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Watch for This Sign Of Customer Service

Remember, look it up first in *Composite Catalog*.

COMPOSITE CATALOG

P. O. BOX 2608 **HOUSTON 1, TEXAS**

NEW LITERATURE

Copies may be obtained easily and without cost by using Reader Service Postcard. Just circle on the card the number at the end of each item in which you are interested. The convenient Postcards are on page 61.

Cable Reel Jacks

Cable reel jacks for lifting and holding heavy reels are covered in a new two-page bulletin published by The Duff-Norton Manufacturing Company. Designed for handling cable reels from 20 to 90 inches in diameter, these jacks are available in capacities of 5, 10 and 15 tons.

Circle No. 36 on Postcard

•

Rope Cut-Off Chart

A simplified rotary drilling wire rope cut-off chart is available from A. Leschen & Sons Rope Company. The chart is printed on heavy, plasticoated stock, punched at top for convenient hanging. It shows approximate lengths of rope to cut, at the proper intervals, according to rope size, drill pipe size, excess weights, and depth of hole. Additional information for wire rope users is printed on the reverse side of the chart.

Circle No. 37 on Postcard

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Spectrometer

Construction, performance and accessories of the new mobile Model 112 Double Pass Infrared Spectrometer are detailed in a new illustrated bulletin issued by The Perkin-Elmer Corporation.

Circle No. 38 on Postcard

•

Expansion Joints

An illustrated bulletin describing the new Flexon line of expansion joints has been released by Flexonics Corporation. Design changes make the joints capable of accommodating increased expansion with fewer corrugations. The bulletin gives specification and installation data.

Circle No. 39 on Postcard

•

General Purpose Motors

Construction, ratings and dimensions of Allis-Chalmers open drip-proof (Type AP) and splash-proof (Type APWW) squirrel-cage induction motors in ratings of ½ to 100 horsepower are described in a new bulletin issued by Allis-Chalmers Manufacturing Company.

Circle No. 40 on Postcard

Motor Applications

Westinghouse Electric Corporation's line of Life-Line motors is the subject of a new 35-page booklet. The more than 100 case histories represent practically every phase of industry, and show the application problems involved, motor choice for the job, and the results.

Circle No. 41 on Postcard

•

Regulating Valves

Leslie Company has released a new bulletin on its Double Seated Diaphragm Regulating Valves for use with control instruments. The publication points out that the seat rings in the new valve can be replaced with the valve in the pipe line, and it is not necessary to set up in a lathe or grind in a high temperature.

Circle No. 42 on Postcard

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Protective Coatings

A general catalog covering the company's entire line of protective coatings has been released by Pruf-coat Laboratories, Inc. There is a list of chemical agents against which Pruf-coat has been found effective, and case history studies of five different applications in various industries.

Circle No. 43 on Postcard

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Flow Meter

Variable-area flow meters with tapered metal metering tubes are described in Fischer & Porter Company's new catalog. Armored Flowrator meters are designed for both high temperature and high pressure, and for use where liquid hammer and hazardous fluids make ordinary meters impractical.

Circle No. 44 on Postcard

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Graphitization

Edward Valves, Inc., has made available the findings of a study of the graphitization phenomena encountered in systems operated at elevated temperatures. The illustrated booklet describes in detail the nature of graphitization and its effects, and lists preventive and corrective measures.

Circle No. 45 on Postcard

Big Motors

"Application of Large A-C Motors," by G. L. Oscarson, chief application engineer for Electric Machinery Manufacturing Company, is a discussion of the characteristics of the motors which fit them to various industry requirements. The 18-page booklet covers the highlights of synchronous motors, induction motors, and motor control and gives hints on selection of motor types for specific applications.

Circle No. 46 on Postcard

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Controller

Eight types of the Model 40 controller are described in The Foxboro Company's new 32-page bulletin. With its standard specifications, or available modifications, each instrument can be specifically engineered to its application, whether controlling temperature, pressure, flow, pH, or conductivity.

Circle No. 47 on Postcard

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Metallic Sodium

National Distillers Chemical Corporation has issued a 24-page booklet, "Handling Metallic Sodium," which discusses the safe handling of metallic sodium from one pound bricks to 80,000-pound tank cars. Safety precautions and first aid information are included.

Circle No. 48 on Postcard

•

Packaged Drives

An eight-page booklet, issued by Reliance Electric & Engineering Company, presents a simplified explanation of the Reliance V*S Drive, its "economics," application versatility, and operational flexibility of the packaged all-electric drive in providing adjustable speeds.

Circle No. 49 on Postcard

•

Seamless Tubing

A data card published by Tubular Products division of The Babcock & Wilcox Company shows applications of seamless cold-drawn carbon steel mechanical tubing in hollow precision parts.

Circle No. 50 on Postcard

Finding Faded Structures

Photogeologic Prospecting Can be Effectively Combined With Other Methods in Studying Blanketed Formations

Part 1

By

ROBERT R. WHEELER and NORMAN C. SMITH

Consulting Geologists, Dallas

OLD structures simply fade away. Even long after the major diastrophic events of the region have ceased, the lingering tendency for positive features to remain positive commonly requires convergence of the later sediments over highs and differential compaction of the thicker sediments on the flanks and adjoining low areas. These adjustments to buried structures may be so imperceptible in the disposition of surface rocks as to be missed by conventional surface mapping programs. Yet it is remarkable how widespread are the areas, generally avoided as unmappable by surface expression, that can be deciphered by using the unique perspective provided by aerial photography.

The object of this article is to explain how photo interpretation of physiographic anomalies, irregularities of soil pattern and the areal geologic disposition of successive formations integrated with subsurface local and regional evidence provides a rapid economical method of locating favorable prospects in regions that are obscure to conventional surface mapping because of poor rock exposures and widespread cover of soil and vegetation.

The authors have collaborated for many months analyzing the surface and subsurface indications of major and minor local structural features. One author has approached the mapping of oil prospects from the subsurface viewpoint, especially from the genetic or historical geological approach, seeking to locate favorable areas for structural and stratigraphic traps by a study of the orogenic events that have interrupted regional deposition.

The other author has specialized for several years in the interpretation of air photographs with emphasis on the origin of physiographic abnormalities and their relation to structure. It is a fascinating study, and one main reason for its appeal is that it clears up in a most reasonable way evidence, that has been somewhat overlooked by geologists, relating stream behavior to structural obstacles and residual soil pattern and relief characteristics to the structural attitude of near-surface strata which might not otherwise be understood.

FIGURE 1. Subsidence and deformation controlled by Pre-Cambrian stabilized positive features.

THE DUAL APPROACH. In collaboration these two approaches can be used to great advantage. The subsurface geologist, with scattered well data, can be led to favorable photogeologic prospects that, on reanalysis, find subsurface support, whereas the photogeological prospects may not always be sufficiently prominent to stand unsupported. Nor would the surface approach on its own provide answers to the depth and quality of oil objectives which in the final analysis are essential to the oil operator.

This presentation is not intended to exhaust the field of photogeologic technique. It analyzes the applicability of joint photogeologic-subsurface mapping to widely diverse oil provinces, drawing for these regional studies certain basic principles of the relation of buried structure to such mapping techniques, and concludes with an appraisal of the usefulness of these techniques to exploratory needs in "blanketed" regions.

Photogeological Techniques

The authors are especially concerned with the interpretation of air photographs over areas lacking the bold outcrops of such mountainous regions as the Rockies, where air photo interpretation has served the industry well in reducing the time and expense of surface mapping. Dealt with here is the problem of interpreting the geologic significance of the vast plains of the Midcontinent and Gulf Coast regions where one is chiefly dependent upon physiographic criteria. Dr. Frank Melton[1] has discussed some of the problems encountered in his "Photogeological Study of the Flatlands."

The authors must make the basic assumption that structural deformation originating at depth, may be revealed at the surface and, by influencing the physiographic processes to varying degree, controls the resultant land forms. Whereas proximity to ground detail tends to destroy perspective, the reduction of the surface to convenient scale furnished by air photography restores the continuity by which scattered surface evidence takes on a discernible pattern.

Currently therefore the authors are attempting to evaluate to what extent such air photo interpretation may be integrated with the regional

and local geologic history to produce a reliable exploratory tool. The plan is to analyze and illustrate specific examples representative of a variety of tectonic and physiographic provinces.

Photogeologic interpretation involves no new geologic principles. It actually emphasizes the importance of physiographic anomalies and exploits the built-in perspective of air photography. These may be recognizable in the pattern of stream drainage and in the soils and related vegetation. Why this appears to be so is worthy of serious consideration.

REJUVENATION AND COMPACTION. We have learned through geologic experience that compaction and differential settling of consolidating sediments tends to perpetuate a structural axis upward toward the surface. Depending upon the succeeding thickness of the sedimentary sequence and the frequency with which the structural forces are interrupted by periods of emergence and planation, the prominence of old structural features will vary in surface expression. Hence drainage developing upon the surface will be diverted from normal pattern by texture and relief imposed by buried structure to the extent of local entrenchment, change in meander pattern, or deflection around structural areas to accentuate topographic relief.

Similarly a massive sedimentary feature possessing relief, such as a reef, although not of tectonic derivation, may localize differential compaction, just as would a topographic prominence on a buried unconformity. Probably structural axes, which may be repeatedly rejuvenated, die out more slowly than the sites of differential compaction due to inert abnormalities of lithology.

"BLANKETING" AGENCIES. To what extent these structures may be further obscured at the surface by climatic factors, is a serious problem to the photogeologist, and may constitute insurmountable difficulties for the surface geologist. In the arid regions of South and West Texas, a caliche crust, neither transported in the usual sense nor yet truly residual, tends to obscure geologic evidence ordinarily needed for structural mapping. However, even in such unfavorable terrane the photo interpreter may map a fracture pattern and abnormalities of intermittent drainage that appear to be adjusted to the regional structural pattern.

In a different manner the eastern Gulf Coast commonly has been regarded unfavorably for surface investigation because the mapping horizons are generally blanketed by unconsolidated terrace materials which in turn may be covered by heavy forest and swampland. Despite such difficulties, vegetation and soil zones may permit areal mapping, possibly because of a relation between soil and circulating ground waters or buried mineral sources available to root systems. Even in the delta country of widespread swamp conditions beyond the terraced areas, abnormalities in the Mississippi River and its tributaries have been recognized to have structural adjustment.

On the basis of these simple principles, an effort will be made to evaluate the applicability of photo interpretation, especially where it can be integrated with the tectonic history of each region.

Tectonic Framework

The authors are impressed by the fact that a comprehension of the historical geologic events is a prerequisite for oil finding. It is not adequate to seek structural and stratigraphic prospects merely by comparison with what is locally known to be productive. It is necessary to understand the sequence of depositional and interrupting orogenic episodes that have created structural traps, stratigraphic convergence and facies change responsible for oil accumulation. Regional studies have permitted some interesting generalizations concerning the localization and pattern of the mobile belts, characterized by maximum subsidence, deposition and orogenic activity.[2]

STABLE AND MOBILE FEATURES. For example (see Figure 1), Cambrian to Recent subsidence and mountain building lies peripheral to the Continental nucleus; that is, the Canadian Shield composed of pre-Cambrian basement rocks. Scattered here and there across the continent, beyond the Shield proper, are isolated pre-Cambrian masses, usually domal in shape, which have predetermined the course of Paleozoic to Recent deposition. In the general Midcontinent region we can observe at least three such prominences which, like the Canadian Shield, have been stabilized by pre-Cambrian orogenic events, so deformed that they remain resistant to all subsequent subsidence and mountain building. These are the Ozark, Central Kansas and Llano uplifts.

The disposition of these three stabilized features, flanking the Ouachita geosyncline, permitted a prong of the Paleozoic seas to extend northwestward across northern Texas and southern Oklahoma, in which there were subsequently deposited some 15,000 feet of Cambrian to early Pennsylvanian sediments. In contrast, the adjoining stable features, resistant to subsidence, accumulated much thinner and more frequently interrupted equivalents. Continuing subsidence and compression between the stabilized nodes created a belt of intense deformation across northern Texas and southern Oklahoma.

A number of the currently active

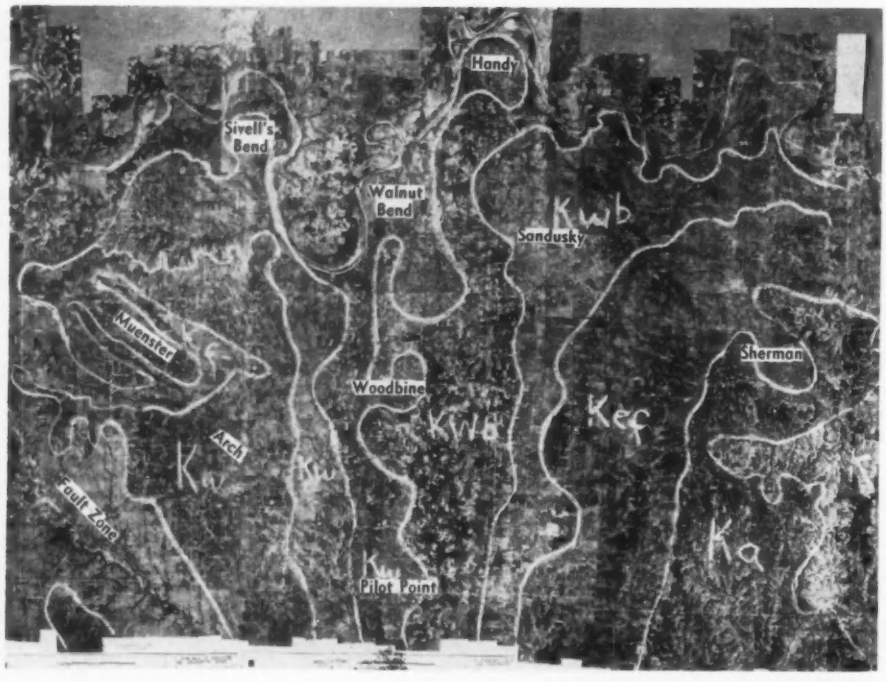
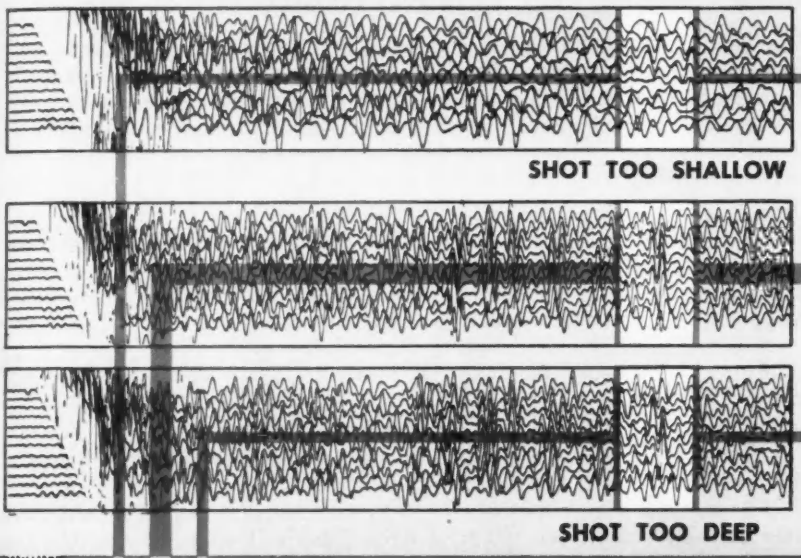
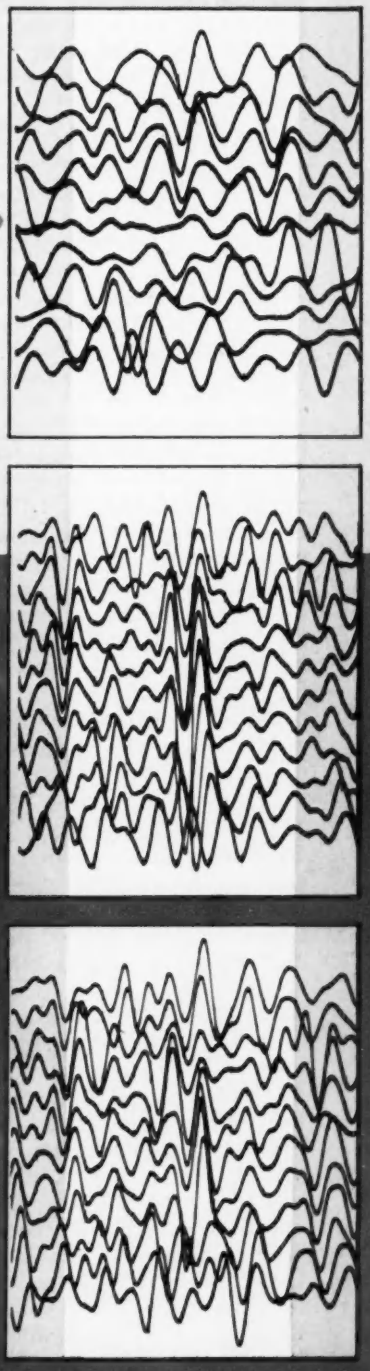


FIGURE 2. Geomorphic zones in Cooke and Grayson counties, Texas, based on residual soil patterns closely related to the blanketed parent Cretaceous formations.
Photo—PMA, U. S. Department of Agriculture, Washington, D. C.

Basic Methods for Improving Seismic Records . . .

The Effect ...of DEPTH of SHOT





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oil provinces are secondarily derived basins bordering orogenic features of early Pennsylvanian age: for example, the Anadarko Basin of western Oklahoma and northern Texas, and the McAlister Basin of southeastern Oklahoma, the latter squeezed between the stable Ozark Uplift and the overthrust plates of the Ouachita orogeny. In other words,[3] the axis of the southern Oklahoma basin, having received the thickest load of Paleozoic sediments, localized the belt of most severe deformation from which subsidiary basins were derived to the north and south of the Arbuckle-Wichita-Amarillo uplift, and filled with Middle Pennsylvanian to Permian sediments.

Just as the southern Oklahoma orogenic province developed to the north of the Llano Uplift, the Permian Basin developed later in Paleozoic time to the west. Here it is inferred that the Central Basin Platform is an orogenic feature derived from the mobile heart of a late Paleozoic basin in which Pennsylvanian to Cambrian rocks were sharply folded, faulted and truncated, and adjoining which the Midland and Delaware Basins were secondarily derived. Rejuvenation of older fold axes seems to have occurred in later Permian time, although impression is that Permian deformation dies out toward the Eastern Platform bordering the Llano Uplift. There seems to be a relation between the degree of subsidence, the texture of the thin platform and thick basinal facies, and the mobility of these sediments which is revealed by the mechanics and severity of their deformation.

Whether or not the Sabine and Monroe uplifts of East Texas and adjoining states may have a derivation similar to the stabilized Pre-Cambrian masses previously mentioned; whether or not, indeed, these may constitute the mystic landmass of Llanoria (which is assumed to have furnished sediments to the Ouachita geosyncline), at least it is known that these were positive areas during Mesozoic time and that an East Texas basin of relatively thick Mesozoic deposition lies between the Sabine and Llano uplifts. A linear belt of tensional faults, the Balcones and Mexia systems, borders the Llano Uplift and the highly deformed Ouachita thrust system, constituting the hingeline of the subsiding Gulf Coast geosyncline. Phillip King, in his recently published "Tectonics of Middle North America,"[4] seems convinced that this trough may have suffered maximum subsidence in Miocene times, but might be regarded as a still active geosyncline, not yet having received true orogenic deformation and resultant stabilization.

With this very generalized background, consider the relation between regional geologic history and its surface revelations through air photo interpretation in various structural provinces.

About the Authors

Wheeler

ROBERT R. WHEELER and NORMAN C. SMITH have collaborated for many months combining subsurface and photogeological techniques to the search for oil prospects. Wheeler, who has a Ph.D. from Harvard University, worked for several oil companies and is now consulting in Dallas. He has contributed several articles to WORLD OIL on Midcontinent oil possibilities.

Smith

Smith, also consulting in Dallas, has an A.B. degree from Washington & Lee University and graduate credits from Harvard. His photogeologic experience is derived from Gulf Coast mapping for Humble Oil & Refining Company, Naval Photo Intelligence and the Naval Petroleum Reserve in Alaska.

Regional Studies

MUENSTER ARCH-MARIETTA BASIN. The structural province bordering the Red River between northern Texas and southern Oklahoma has proved unusually favorable for the joint mapping techniques for several reasons. In the first place, (see Figure 2) the major drainage of the region, the Red River, shows many abnormalities that can be directly associated with known structural features. Similarly, the tributary drainage to the Red River and to the Trinity River (flowing southeastward toward Dallas) reveals physiographic evidence of structural anomalies. The eastward dipping Cretaceous rocks have so clearly influenced the tone and cultivation pattern of the soils that it is possible to delineate formation contacts. Finally, this folded belt bordered on the west by the Muenster Arch and, in southern Oklahoma by the Criner Hills axis, has suffered early and late Pennsylvanian diastrophism on an extensive scale which has created many structural features, some of considerable sharpness and magnitude.

At the outset, one acquainted with the general geology of the region might doubt that the Pennsylvanian structures, which had been unconformably covered with non-marine Permian red beds and these in turn unconformably overlapped with gently dipping Cretaceous rocks, could be revealed at the surface, especially since structural mapping of so gross a feature as the Muenster Arch shows only minor warping on a Cretaceous map datum. But, here again study of the photo evidence shows a major northwest trending abnormality in the distribution of the Cretaceous rocks and related peculiarities of the entrenched tributary drainage that have a direct relation to the tectonic pattern of this buried mountain.

From the crest of the Muenster Arch (about 10 miles west of Gainesville in Cooke County, Texas), where truncation has locally permitted the upper Pennsylvanian to lie upon granite basement rocks, eastward to Sherman in central Grayson County, Texas, near the axis of the Marietta-Sherman syncline, there is an overall structural relief over 10,000 feet. By way of comparison, there is somewhat less than 1000 feet of structural relief on the base of the Cretaceous across the same profile so that it is indicated that at least the major structural features of the region influenced the thickness and structural attitude of the overlapping Cretaceous sequence.

Whereas the Sherman syncline is revealed in the geologic map of Texas by the arcuate distribution of Cretaceous outcrops, the Muenster Arch is not obvious either in the areal pattern of the Cretaceous rocks nor by structural mapping of these beds. Yet, with the benefit of perspective and continuity provided by air photography this broad uplift seemed fairly well defined by abnormalities of the drainage pattern and soil tone.

Likewise, many of the structurally prominent producing features of this province are convincingly indicated by photographic study of related physiographic abnormalities. Of these one of the most promising along the

■ CONTINUED ON PAGE 82

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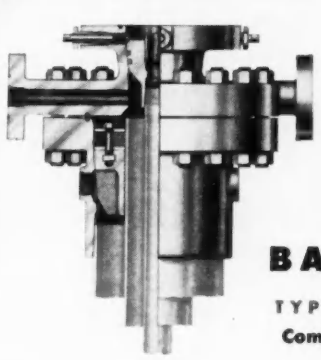

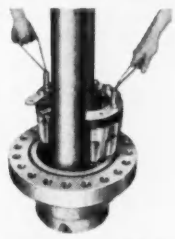

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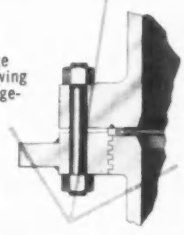
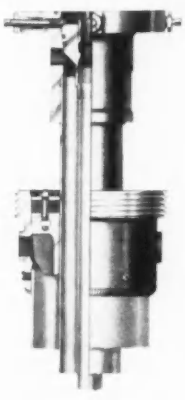
View of Flange installed showing packing arrangement.





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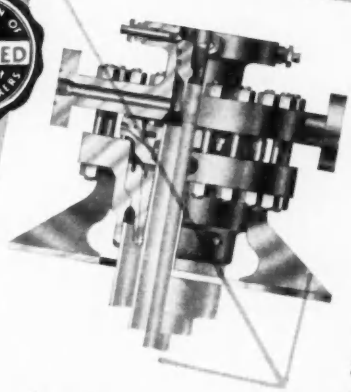

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Radioactive Oil Survey Technique

Geochemical Methods Link Oil at Depth to Mineral Concentrations And Radioactive Emanations in Soil at Earth's Surface

By DR. JOHN W. MERRITT

Consulting Geologist, Tulsa

SOME of the largest and most prolific oil pools, such as the East Texas field, occur in stratigraphic traps. These accumulations have not been readily revealed by structural geology and geophysics, the conventional exploratory methods based on finding structural traps favorable for oil accumulation. Therefore efforts have been made to develop trustworthy methods for discovering stratigraphic traps through refinements of the conventional methods or finding other methods.

Early in oil development history it was observed that gas seepages were common, especially above salt domes. It then ocurred to observers that if some productive domes were marked by visible gas seepages, perhaps all producing fields might be found to permit the escape of gas in a much lesser, though measurable degree. These studies led to chemical analyses of soils with extremely delicate equipment to find and evaluate such gas movements and to develop a significant pattern. It was soon found that when care was taken in testing the soils above known oil production, a pattern resulted showing a greater hydrocarbon content there, as compared with the barren ground sur-

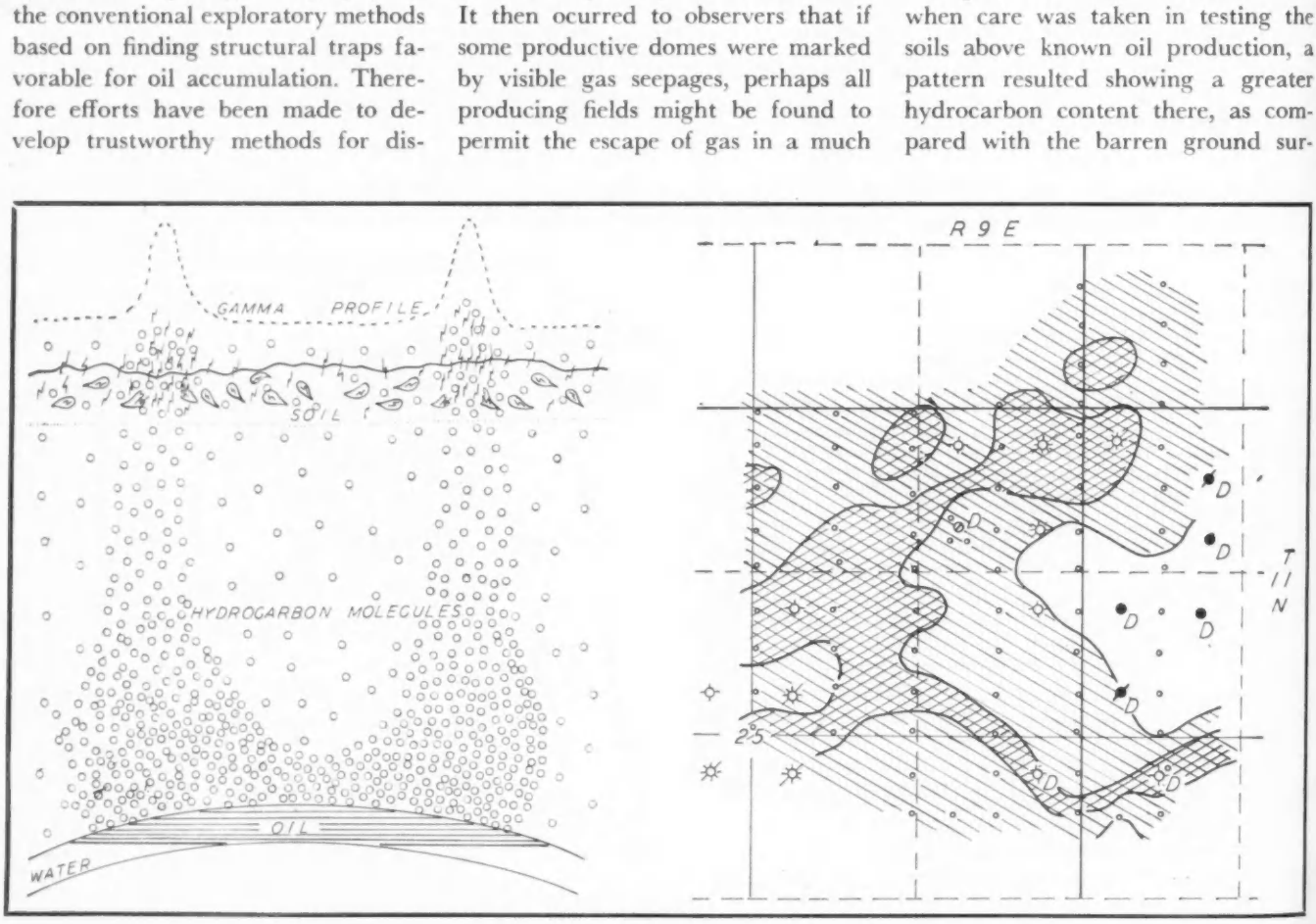

FIGURE 1 (left). Hypothetical cross section through oil structure, showing pattern of hydrocarbon gas molecular movement from oil body to surface and movement of ground water carrying radioactive elements in solution to build up concentration over margins of oil.

FIGURE 2 (right). Surface gamma ray map of area in Okfuskee County, Oklahoma. Double-ruled areas carry high values, single-ruled areas intermediate and white low. Wells marked "D" are deep.

rounding the production. Strangely, the density pattern frequently took the form of a ring or halo of high values lying approximately directly above the margin of production.

Geochemistry Developed

Out of these observations was developed the new technique of geochemistry. This new exploration method was quickly put to work, with some success. Many of the faults of this method were due to an insufficient understanding of the variables which had to be considered and corrected for. Some of the failures were due to the interpreter having insufficient geological background to understand and explain the more complex patterns. Some of the variables which must be considered in this method relate to variations of temperature and atmospheric pressure from point to point, variations in porosity and moisture content of the soil examined, and variations in grain size and chemical nature of the soil. In spite of these difficulties, however, considerable success followed this method.

Later, to get away from temperature and pressure variables and to facilitate and cheapen the sampling technique, an inorganic method was developed. Chemist found that in spots where there is an excess of gas movement and escape there is also an excess of water evaporation. Thus, if there should be a halo-like band of excessive gas movement, the water in that band would evaporate much more rapidly. Then this water would be replaced naturally by capillary movement by water from either side of the band. Since the escaping water cannot take with it any dissolved minerals, and since new water coming in brings with it the normal load of such minerals, there is gradually built up an excessive quantity of minerals in solution occupying the same area as that occupied by the gas halo. Analysis of the soil to develop a density pattern of water-soluble inorganic materials then became a new method of geochemistry. This method proved to be unaffected by changes in temperature and atmospheric pressure. The pattern was stronger, also, because the values were cumulative.

One of the difficulties in evaluating a geochemical pattern lies in the fact that in no place, whether barren of oil production or not, is the distribution of hydrocarbons or water-soluble minerals uniform. There will always be found highs and lows surrounding one another. It becomes the duty of the interpreter, therefore, to study the pattern of such variables in order to see whether it makes geological sense and indicates by its shape and character a possible oil or gas pool.

New Method

In planning a survey, the geochemist sometimes is guided by geological information. But even so he does not necessarily have any idea aboveground whether oil or gas might be found or, if so, where the margins might be. Frequently, therefore, his sampling may prove to be either excessive or insufficient in area. As a result, either too much field work is done or another trip to the field becomes necessary in order to round out the survey and make the geochemical pattern all-inclusive.

To escape these difficulties and to facilitate the work in other ways, a new method came into being. If the escaping gases from buried bodies of oil or gas cause the development of a pattern of high valves in water-soluble inorganic substances, possibly some of these substances may be radioactive, and if so, possibly even such weak radiation as might occur can be measured, if instruments of sufficient sensitivity can be built. It was soon demonstrated that such radioactive solutions do occur and methods of measurement have been devised. Instruments designed for these measurements had to have a degree of sensitivity from a thousand to several thousand times that of the average Geiger Counter in order to make it possible to do the field work with economical rapidity.

There are four general types of radiation, of which three are or may be related to the geochemical pattern above oil or gas production. They are alpha, beta and gamma, which come from the earth, and cosmic, which comes from beyond the earth. The alpha ray has very weak power of penetration, not being able to pass through even the thinnest sheet of tissue paper. It is in the form of radon gas. To measure this ray it is necessary to pump the air from the soil into a chamber where ionization creates a measurable current of electricity sufficient to discharge a charged gold foil. The time elapsing during this discharge may be taken as a measure of the alpha intensity. The beta ray is able to penetrate a very thin sheet or "window" of aluminum, allowing it to enter an ionization chamber, and there the current created by the ionization of the gas medium of the chamber may be stepped up sufficiently so that the current may be recorded on a meter.

Gamma More Useful

Gamma rays are much more powerful in their penetrating ability, and can pass through the steel walls of an ionization chamber. Because of this penetrative ability, gamma is much more useful as a pattern maker for surface radiation mapping. Cosmic

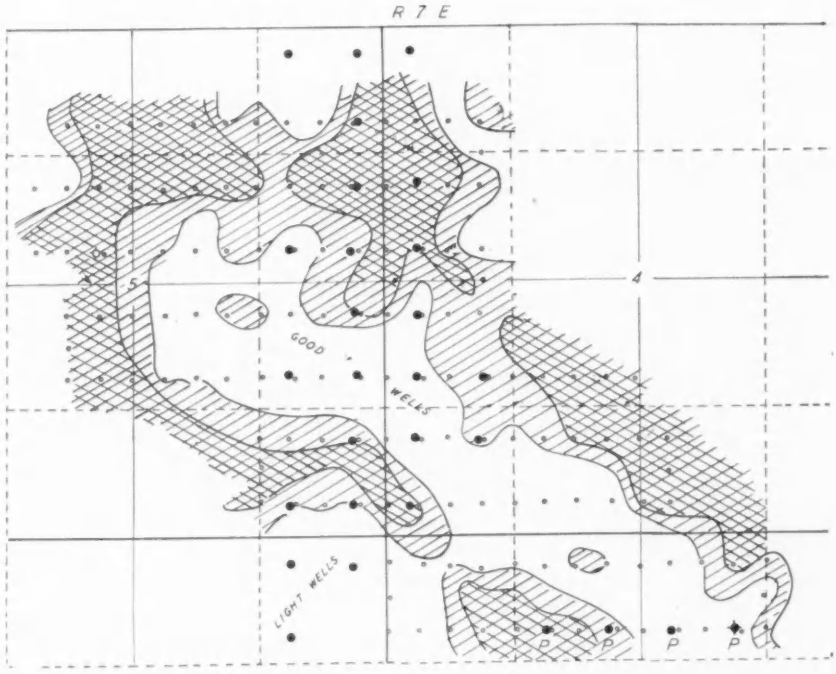

FIGURE 3. Gamma ray extension survey at north end of Naval Reserve pool in Osage County, Oklahoma. Wells marked P in production at time of survey. Extension discovery was in SE NE SE of Section 5.

rays are not obtainable from the surface formations of the earth, but they come from outer space, as their name indicates. They are extremely powerful and have been measured underground where they had to pass through several hundred feet of rock. Most gamma rays, however, lose their power and are absorbed in passing through at little as three or four feet of soil. Fortunately, cosmic rays are relatively constant in value from hour to hour, so that their value as recorded on the meter can be ignored as a constant in recording the over-all pattern. An exception must be noted, however, when "cosmic bursts" or "cosmic showers" occur, resulting in very sudden high meter readings. They are short-lived, usually lasting only for a few seconds. The operator ignores such readings and repeats his work until the abnormal readings disappear and the results level out.

Ignoring the cosmic rays, the sources of radiation measured at the surface of the earth are: (1) insoluble or undissolved radioactive substances in the soil or surface rocks; and (2) water-soluble radioactive compounds in the top soil or surface bed rocks within penetrating distance for gamma rays from the earth's surface. The former, naturally, are immobile and would have no relation to the movement of petroleum gases and water evaporation, unless they were precipitated from the moving and evaporating water. However, they would add their values to the total radiation readings and would form a part of the background value pattern. The latter sources would tend to conform to the geochemical pattern and, normally, should be related to the pattern of oil occurrence above which they are measured. For this pattern to be significant, it should be of sufficient strength to stand out over and above background irregularities, so as to be dependably interpretable. Figure 1 is a diagrammatic cross section showing the theoretical explanation of the inorganic (and radioactive) pattern arising because of the movement of gas and water above oil or gas production.

Need Supersensitive Equipment

This article is concerned mainly with the use of radiation intensity mapping for the purpose of locating oil production, and not with the equipment used for that purpose. Consequently, the methods of taking these measurements and the equipment used for it are passed with the statement that the equipment must be supersensitive, and at the same time stable and dependable, if good results are to be obtained. Whenever a ray encounters an atom in passing through that medium, it causes a disruption, separating the positive ion from the negative ion. This disruption can be recognized by sound, as in the Geiger-Müller counter, or the two separated ions, contacting opposite poles of an electrical circuit, may create an electrical current which can be stepped up through amplified circuits and passed through a meter, where the values may be read directly or may be recorded on a chart automatically.

By using a medium which becomes luminescent upon contact with these rays, their intensity may also be measured by use of a photoelectric device. This type is known as a scintillator. Because the collision of rays with atoms in a gaseous medium is accidental, there is certain to be considerable variation in the number of contacts in any small given length of time. Consequently, it is desirable to multiply the number of collisions by use of a large chamber, filled with a great quantity of the gaseous medium (increasing the mass of the gas by using pressure), or to have a large area for scintillation, in order to smooth out the curve of contacts and reduce the "statistical" variations as much as possible.

FIGURE 4. Small surface gamma ray map of area in Creek County, Oklahoma. Doubled circle dry hole was only well drilled at time of survey.

Difficulty Noted

From a study of the theoretical diagram (Figure 1) it will be noted that normally there is to be expected a band of high radioactivity marking the approximate margin of the oil or gas occurrence. If there be but one oil or gas horizon, this will be a simple band. On the other hand, if there be more than one horizon, each producing zone will be marked by its own high value band so that, if the margins of the different zones do not coincide vertically, the pattern resulting at the surface will comprise a composite of all margins. In lenticular areas, therefore, this kind of oil or gas occurrence may become extremely difficult to interpret from the surface radiation pattern.

Besides variations in pattern due to multiple sand horizons, other irregularities in radiation intensity occur which must be noted and their effect taken into consideration when making interpretations. Loose, sandy soil in an area otherwise more argillaceous or loamy yields abnormally low readings. Bed rocks at or close to the surface in which the pore space is low act as shields and reduce the normal readings. Mineralized bed rocks sometimes yield high values. Standing water or fully water-saturated soils

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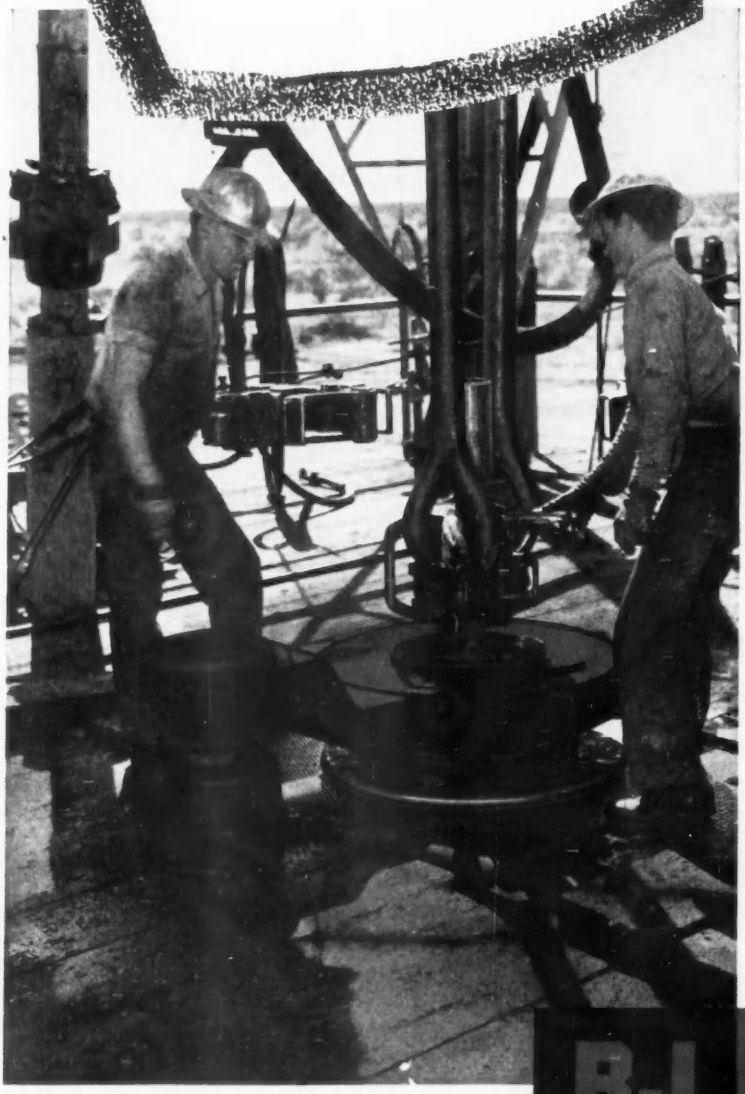

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also act as shields and reduce the values. Variations in porosity and water-saturation in soils cause minor variations in normal values, but such variations are difficult to evaluate and, as a consequence, no pattern is smooth and regular in shape. It is the custom of the careful operator to mark all readings that appear abnormal so that the interpreter will be warned to make proper allowance for their possible irregularity. All of the above described irregularities tend to be confusing and the interpreter must use extreme care to confine his interpretation to values which are safely to be considered normal. One of the best insurance policies for safe interpretation is to see that the anomalies stand out well above the natural irregularities of the background.

Observation Points

In planning a radiation survey, consideration must also be given to the arrangement and density of observation points. Upon the basis largely of trial and error, it has been found that where pools of 160 acres or less are surveyed, points should be selected in gridiron pattern at intervals of 330 feet, in order to be certain to detail with proper care the significant anomalies. Thus, one out of every four points will also occupy a standard ten-acre drilling location. In larger areas, say up to a thousand acres or a little more, profiles 660 feet apart, with points therein at 330-foot intervals, will yield sufficient detail to enable the interpreter to handle the problem successfully. On the other hand, in large fields with considerable breadth as well as length, profiles at quarter-mile intervals should be suitable. All spacing within profiles should be 330 feet, with the exception of those crossing narrow shoe-strings, in which case they should be spaced at a maximum of 165 feet.

Where the operator has some dependable geological information and wishes to do some reconnaissance work before going into a costly detailed survey, it is permissable to run three or four cross profiles at standard intervals across the best part of the structure, extending the lines well outside the last possible chance of locating a producing boundary. If these lines do not encounter marginal anomalies, the prospect may then be considered unworthy the expense of detailed work.

Whenever a producing well or a well with sufficient dependable showings of oil or gas occurs within an area to be surveyed, this information may be tied to the survey and the marginal boundary discovered and then followed around until the possible productive area may be fully delineated.

About the Author

DR. JOHN W. MERRITT of Tulsa is a pioneer in the field of radioactivity surveys designed to implement geological and geophysical techniques in oil exploration. He is also one of the first geological consultants to become interested in geochemistry and has contributed a number of papers and lectured before various scientific societies on both subjects. He holds B.S. and M.S. degrees in geology from Northwestern University and a Ph.D. in geology and mining from Wisconsin State University. After teaching geology at Dartmouth College he joined the old Roxana Petroleum Company and in 1922 became a consultant. He has worked in many areas located in the Gulf Coast, Mid-Continent, Central States and east of the Rocky Mountains.

Caution Necessary

Considering the above described variables, and their effect upon the radioactivity intensity pattern, it becomes evident at once that neither this method nor any similarly based one can be handled by rule of thumb but only with the greatest caution and with the application of all possible geological and geophysical information. In other words, these new semidirect methods of exploration must be put together with all other applicable technical information, just as the physician puts all possible symptomatic information together and weighs it before making his diagnosis. Even when conditions seem most favorable, it is not safe to cut too close to the edges in making a location for a test well. For as the reader will observe from the accompanying illustrations, sometimes the production stops short of the inside edge of the high value anomaly band and sometimes extends well out into it. Therefore the first test on a survey should be located as near centrally in the pattern as possible.

Finding Faded Structures

■ CONTINUED FROM PAGE 76

Red River is the Walnut Bend structure which is outlined on the north and west by an abnormal swing in the river course. It is further delineated to the south and east by a reentrant of the Washita-Woodbine contact due to differential erosion of the eastward dipping Woodbine which has been removed from the structurally high area to reveal the underlying Washita.

A second type of structural evidence consists of abnormalities in the alignment of formation contact, particularly down dip reentrants where younger formations have been eroded from positive areas. Other examples in addition to Walnut Bend, are found in the Woodbine pool of Cooke County and the Sherman pool in Grayson County. There are, of course, undrilled prospects located by areal mapping and physiographic anomalies westward along the folded belt bordering the Red River in north Texas and southern Oklahoma.

Note that between the Walnut Bend structure and the Sivells' Bend pool to the northwest there is a pronounced southward arc of the Red River. It is at this point that the photogeologic technique[5] departs from the somewhat outmoded school of "creekology"; for the very reasoning by which northward bends in the river can be explained as avoiding positive areas would suggest that the river works the farthest south in the intervening low areas. This rule of thumb finds fair support in the known structural picture along the Red River. The undiscriminating creekologist might fail to differentiate between the origin of drainage peculiarities and their relation to the tectonic framework. Still he had a good and fundamental geologic idea when he sought evidence of structure in drainage pattern, and his lack of comprehension of the structural and physiographic processes involved and his consequent lack of support by the oil industry is no valid excuse for abandoning the abundantly displayed physiographic evidence so unfortunately ignored by exploratory geologists.

(First of two parts)

REFERENCES

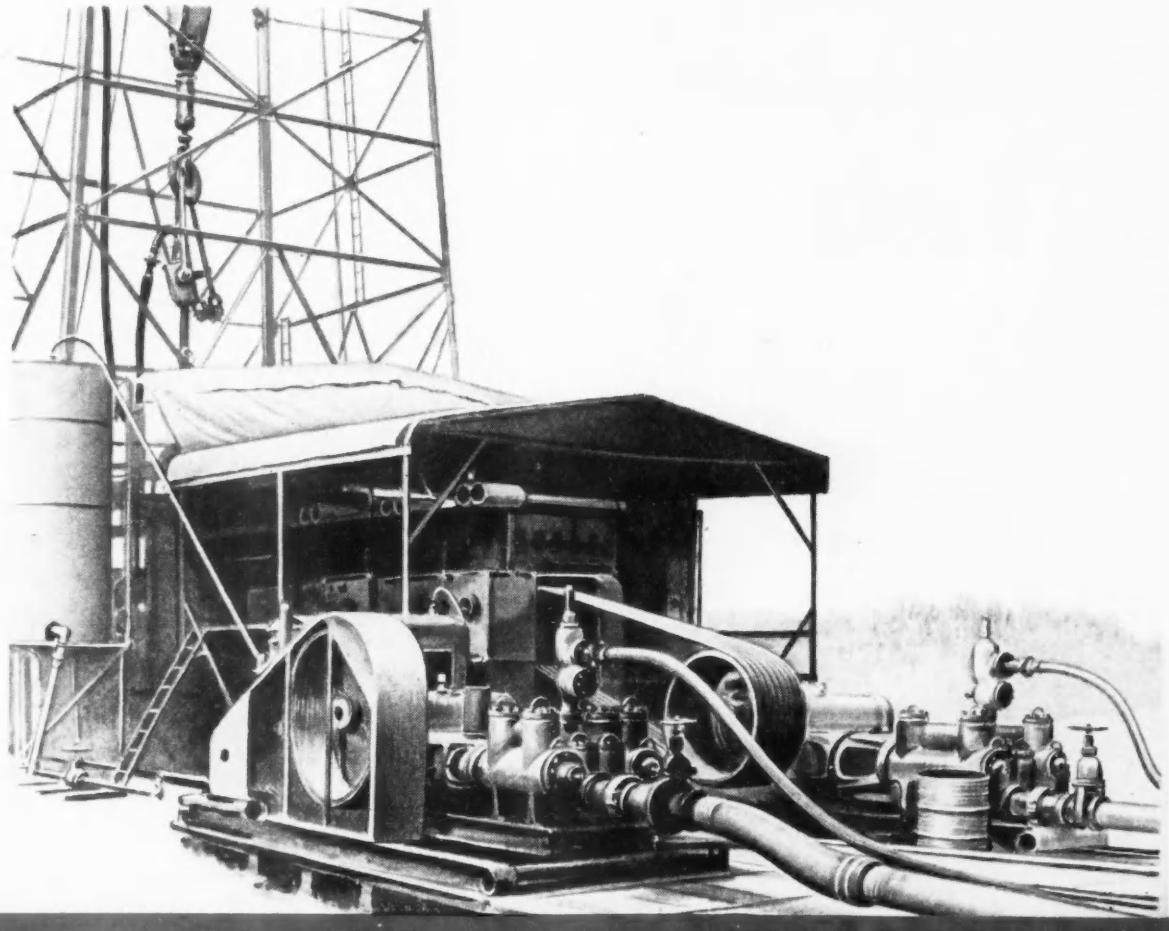
[1] Melton, Frank A.: "Photogeology of the Flatlands," *Mines Magazine*, October, 1950, p. 37 et seq.

[2] Wheeler, Robert R.: "Origin of Oil Possibilities of the Anadarko Basin," *Shale Shaker*, October, 1951, pp. 4-16.

[3] Wheeler, Robert R.: "Theory of Contracting Continents" (Abstract), *Bull. Amer. Assoc. Petrol. Geol.*, March, 1950, pp. 618-19.

[4] King, Phillip B.: "Tectonics of Middle North America," *Princeton University Press*, 1951, 182 pp.

[5] Smith, Norman C., and Wengerd, S. A.: "Photogeology Aids Naval Petroleum Exploration," *Bull. Amer. Assoc. Petrol. Geol.*, May, 1947, pp. 825-28.



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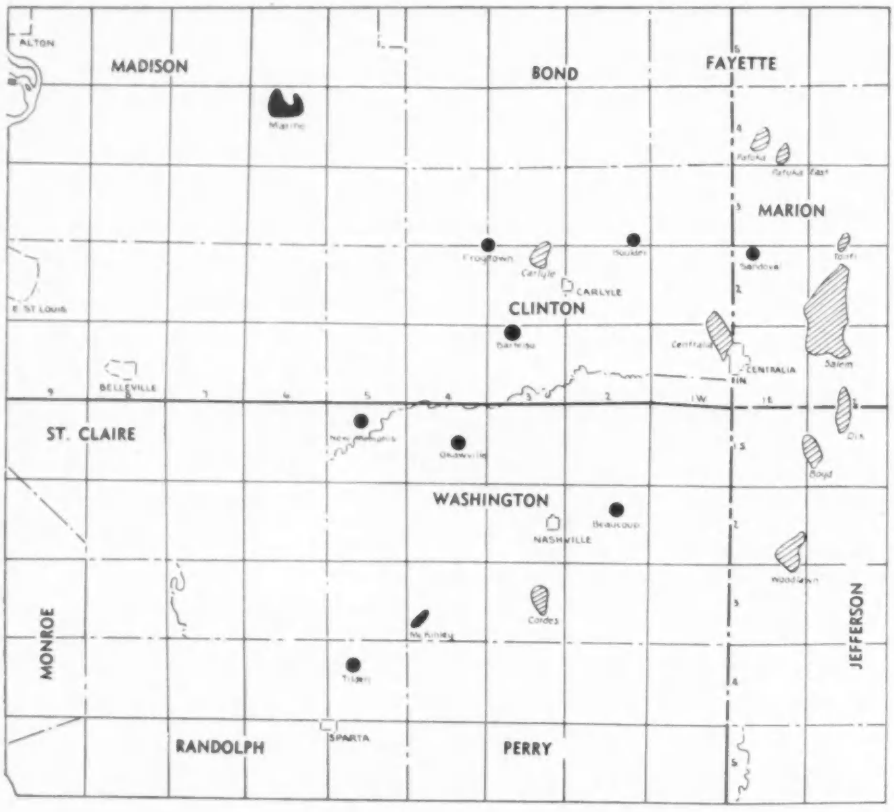

FIGURE 1. Recent oil discoveries in reef-type Silurian-Devonian sediments in southwestern sector of Illinois Basin.

Reef Pools Sought in Illinois

Five New Discoveries Stir Drilling Activity With Bright Prospects for Prolific Trend

By DONALD A. MORGAN
Consulting Geologist
Mount Vernon, Ill.

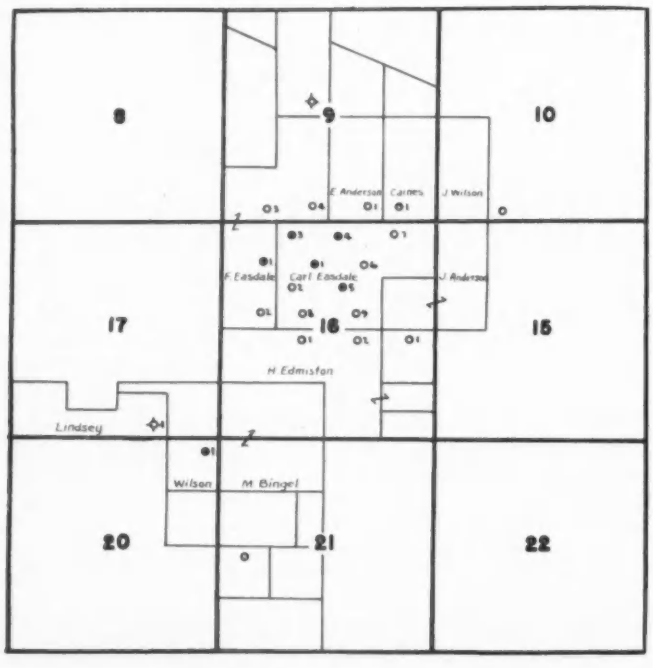

FIGURE 2. Locations of wells in newly-discovered Tilden pool, Randolph County, Illinois, one of more important strikes in reef-type Silurian-Devonian sediments.

THE discovery of five new oil fields in reef-type Devonian-Silurian sediments has started an active drilling campaign in the southwestern sector of the Illinois Basin, with prospects that additional new pools will confirm a prolific reef trend in that section of the Mid-Continent. The new pools, all opened up during the past year, include Tilden, Frogtown, New Memphis, Okawville and Beaucoup (Figure 1).

The major oil possibilities of Devonian-Silurian reefs in Illinois were confirmed in 1943 with the discovery of the Marine pool in Madison County. This pool now covers approximately 3000 acres, and is the largest reef-type oil field in Illinois. As of April 1, 1952, it was producing 2000 barrels of oil per day from 147 wells, with accumulative production of 7,333,000 barrels. The field is producing from an average depth of 1700 feet.

In the adjoining state of Indiana where the Riley and Sioso reef pools were first opened up many years ago, operators renewed prospecting for reef-type production; and the strike at Wilford in the spring of 1948 started an active drilling campaign, which resulted in the discovery of the Spring Hill pool, just south of Terre Haute, the Dome pool, and Blackhawk pool. All were proved to produce from reefs at depths of less than 2500 feet. The Spring Hill pool was

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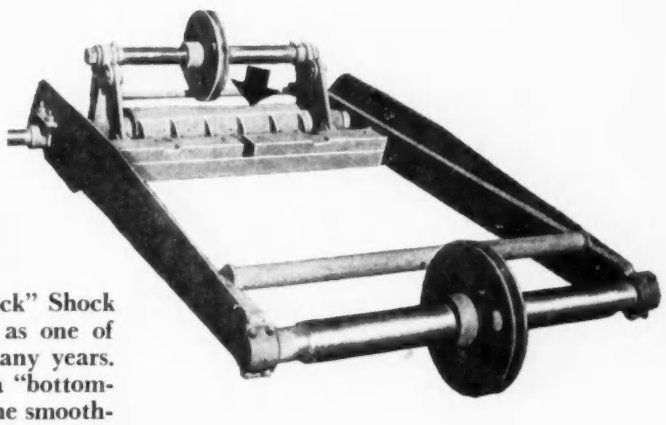

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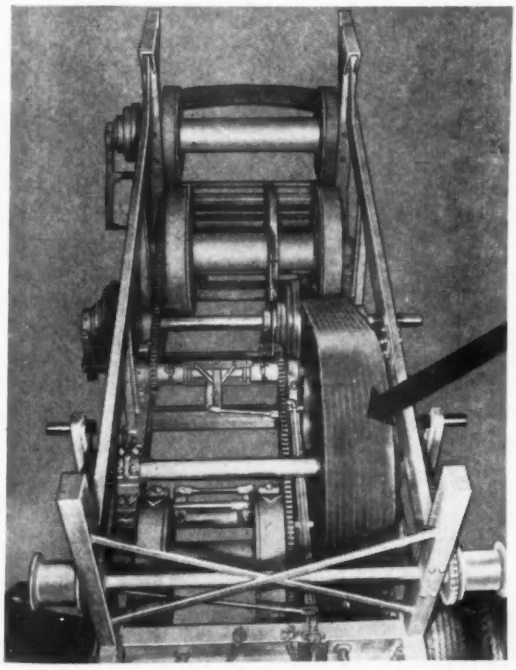

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found to constitute three and possibly four reefs.

These successes in Indiana resulted in considerable interest in Illinois, especially in Clinton, Washington and Randolph counties in the southwestern part of the Illinois Basin. Intensive geologic and seismic studies revealed that for many miles along the western edge of the basin there are many possibilities of encountering Devonian-Silurian reefs at relatively shallow depths. Reefs may occur as single reefs or in pairs or threes, as was proven at Spring Hill in Indiana. These reefs apparently lie in a pattern, and in all cases so far where reef-type production has been found, the younger sediments are structurally high; but structure in the younger sediments does not necessarily mean that a reef will be encountered in depth. In fact, in a number of instances where geophysical evidence indicates the presence of a reef, drilling failed to prove the hypothesis. Geologists and geophysicists are faced with interpretative problems similar to those which confront them in other sections of the country where reef-type production has been developed. Much has to be ascertained, particularly in the geophysical field, concerning reef exploration before a more accurate evaluation can be determined. However, it is believed that the successes encountered during the past year will stimulate a closer study of the problems and that new fields in the reef country of southwestern Illinois will not only add to the state's oil output but will furnish valuable data destined to have an important bearing on reef exploration.

Important Discovery

The most important discovery in reef Devonian-Silurian sediments in Illinois last year was Jet Oil Company's strike in Randolph County, which opened the Tilden pool. The area was recommended for drilling following a careful geophysical survey, and the first well, Carl Easdale 1, 16-4s-5w, was completed for 100 barrels of clean oil per day. So attractive was the geophysical picture that the operator stepped out a mile to the southwest and completed the Wilson 1 in 20-4s-5w for 120 barrels daily, although lower structurally than the discovery well.

However, a northwest offset was dry. The fourth well in the Tilden pool was the Frank Easdale 1, 990 feet west of the discovery, completed for five barrels an hour. The fourth producer was the Carl Easdale 5, which had an initial production of 60 barrels of oil an hour and was finally completed for 600 barrels a day, natural. This well was cored in the reef limestone and found 58 feet of highly saturated reef material.

With the knowledge that Devonian-Silurian reefs were capable of such prolific production, the search for this type of production was intensified in southwestern Illinois. Although the Tilden strike was not the first reef-type oil field found in the area, the excellent production records established by the wells in that area actually revived the search. One of the earlier reef strikes was the Bartelso pool in Clinton County, which was opened up in 1936. In 1940 the McKinley and Sandoval pools in Washington and Marion counties, respectively, were discovered; and in 1941 the Boulder pool in Clinton County became the fourth reef-type oil field found in southwestern Illinois. However, the significance of reef-type production was not fully recognized, and operators were slow to evaluate the prospects, although in all instances production had been found at comparatively shallow depths ranging from 2200 to 2500 feet.

In December, 1950, following a seismic survey, Gulf Oil Company drilled the Frank Warnecke 1, 6-2n-3w, Clinton County, to open the Frogtown pool, producing from approximately 2200 feet. Subsequent wells located structurally high on the reef produced with very high gas/oil ratios. Uncertainty concerning the defined limits of the reef prompted a number of farmouts, and a number of good wells were completed at structurally low positions on the reef. Frogtown and Tilden are two reef-type pools which are currently being developed in Illinois. As in the case of the Indiana reef-type structures, Frogtown and Tilden appear to be what may be designated as "structurally round" structures.

In October, 1951, Gulf again drilled on a geophysical picture interpreted as a reef-type structure and opened the New Memphis pool at its Oelze 1, 3-1s-5w, Clinton County. The well found a very thick section of porosity in the limestone and was completed as a small oil well with a high gas volume. However, Gulf completed its second well for 250 barrels of oil daily from 1950 feet. These are the only producers in the new pool, but wildcatting in the general vicinity of the strike has resulted in the discovery of a subsidiary pool, definitely producing from Devonian-Silurian reef, some two miles southwest of the New Memphis pool. The Collins Brothers strike at Beaucoup, 10-2s-2e in Washington County, was completed for 25 barrels of oil per day from 3050 feet.

Steep Dips Found

Shortly thereafter E. A. Obering encountered reef production, 15-1s-4w, Washington County, at 2325 feet to open the Okawville pool. Very steep dips were ascertained on the east edge of the pool, which is a characteristic of this type of reef. Although somewhat disappointing from the production standpoint, the Beaucoup and Okawville pools nevertheless have stimulated drilling, and it is to be hoped that more prolific strikes will result from subsequent drilling.

Unfortunately, electric logs are lacking for many of the earlier wells drilled in southwestern Illinois, making it difficult to ascertain valid tops, and geologists must depend on drillers logs for this information. However, the Illinois Geological Survey has sets of samples of most of the wells drilled in the state, and in many cases have run these samples. This factor will be significant in future investigation for shallow structural highs.

Geophysical surveys probably offer the best means for locating shallow reefs in Southwestern Illinois. The Barlow limestone affords the most convenient marker for shallower subsurface studies. High structural anomalies do not necessarily indicate the existence of a reef in depth. The successes of the past year give every indication that operators will follow an aggressive drilling campaign this year in a search for Devonian-Silurian reefs in Southwestern Illinois.

About the Author

DONALD A. MORGAN was graduated with a degree in geology from the University of Minnesota in 1939 and a year later joined Socony-Vacuum Oil Company in New York, later being transferred to Venezuela. From 1942-44 he was foreign petroleum geologist for Petroleum Administration for War and conducted geological studies in Europe and the Far East. He joined The Carter Oil Company in 1944 as field geologist at Billings, Mont., resigning the following year to become a consulting geologist in the Illinois Basin area with headquarters at Mt. Vernon, Ill., where he is now located.

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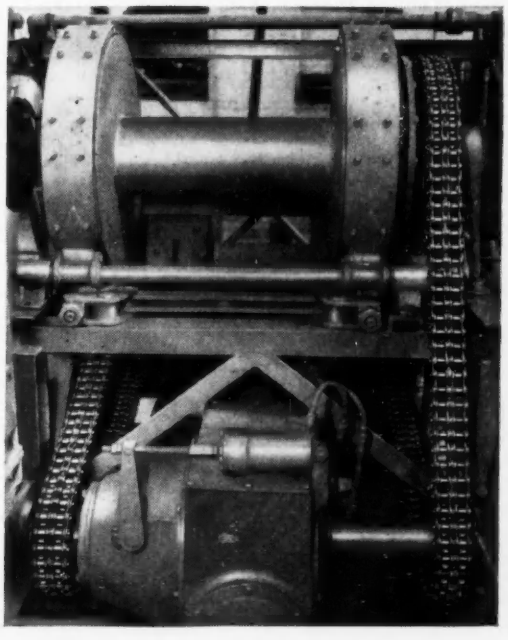

Exploratory Drilling Increased During May

EXPLORATORY drilling has been carried on this year at unprecedented levels and still the rate was stepped up during May, boosting the year's completed wells to a substantial lead over those recorded in 1951's comparable period. Actually, exploratory completions thus far have topped the previous all-time peak by more than 13 percent.

The year's monthly high of 936 exploratory wells were finaled during May, for a gain of 61 wells over the previous month's activity and 35 tests over the previous high registered in January. Results were a little better than average during the month, with 186 successful wells amounting to 19.9 percent of the total completed. A month earlier, the score had been 19.5 percent, and for the first five months of the year the rate was 19.7 percent.

In five months, the industry drilled 4301 tests in the year's stepped-up search for new oil and gas sources. That amounted to an increase of 512 wells or 13.5 percent over the record set in last year's first five months. Of the total, 848 tests found production in commercial quantities, while last year's operations proved 732 locations.

Percentagewise, the year's exploration has been slightly more successful than last year's. In five months, 19.7 percent of all tests completed were producers, while a year earlier the rate of successful drilling had been 19.3 percent. To use other words is to say that slightly less than one producer resulted from drilling five wells in both periods. That comparison includes semi-wildcats (new pay tests and outposts) and rank wildcats. Comparing only the strict or rank wildcats, it is found that current drilling has been 13.6 percent successful against 13.2 percent a year earlier. That means that about one out of 7½ wildcats drilled opened a new area.

Summary of Results of Exploratory Drilling

ITEM	May, 1952	April, 1952	FIVE MONTHS January-May 1952	1951	Percent Diff.
Oil Discoveries	117	108	554	507	+ 9.3
New Fields	93	74	408	360	+13.3
New Pays	24	34	146	147	— 0.7
Distillate Discoveries	17	8	54	35	+54.3
New Fields	13	8	47	25	+88.0
New Pays	4		7	10	—30.0
Gas Discoveries	11	18	81	71	+14.1
New Fields	8	15	63	54	+16.7
New Pays	4	3	18	17	+ 5.9
Total Discoveries	146	134	689	613	+12.4
Extensions to Fields	40	37	159	119	+33.6
Oil Fields	34	28	132	85	+55.3
Distillate Fields	1	1	5	10	—50.0
Gas Fields	5	8	22	24	— 8.3
Total Prod. Tests	186	171	848	732	+15.8
Dry Holes	750	704	3453	3057	+13.0
Wildcats	721	673	3283	2879	+14.0
New Pay Tests		3	9	5	+80.0
Outposts	29	28	161	173	— 6.9
Total Expl'tory Tests	936	875	4301	3789	+13.5
Percent Productive	19.9	19.5	19.7	19.3	.....
Percent Dry	80.1	80.5	80.3	80.7	.....

Results of Exploratory Drilling in May and First 5 Months, 1952-1951, By Districts

State or District	MONTH OF MAY, 1952													FIRST FIVE MONTHS, 1952															
	Productive Tests									Total Productive	Unproductive Tests			Total Exploratory Tests	Productive Tests								Total Productive		Unproductive Tests			Total Dry		Total Exploratory Tests	
	New Fields			New Pays			Extensions				Wildcats	New Pays	Outposts		New Fields			New Pays			Extensions			5 Mo. 1952	5 Mo. 1951	Wildcats	New Pays	Outposts	5 Mo. 1952	5 Mo. 1951	5 Mo. 1952	5 Mo. 1951
	Oil	Dis.	Gas	Oil	Dis.	Gas	Oil	Dis.	Gas						Oil	Dis.	Gas	Oil	Dis.	Gas	Oil	Dis.	Gas									
Alabama			1							1	4			5	1		1							2	2	12			12	8	14	10
Arizona											1			1																1	2
Arkansas											7			7	7		1			2				10	10	27		1	28	31	38	41
California	4			3			2			9	26		4	39	12		1	14			15		1	43	19	134		19	153	205	196	224
Colorado	3		1				1			5	14		1	20	7	1	1	3		2	1			15	2	59		2	61	36	76	38
Florida											3			3												4			4	1	4	1
Idaho																													1		1
Illinois	2				1		5			8	58			66	12			8			17			37	28	187			187	191	224	219
Indiana							1			1	26		1	28	5			2			3			10	13	139		2	141	126	151	139
Kansas	9		1	2						12	90			102	39		5	5			1			50	79	345			345	302	395	381
Kentucky	3			1						4	11			15	8			1			4			13	13	43			43	56	56	69
Louisiana	5	3		1	1					10	23			33	17	10	3	8	2		2		2	44	40	123	1	3	127	116	171	156
North Louisiana	2	1		1	1					5	11			16	8	2	3	4	2		1		1	21	18	60		3	63	67	84	85
South Louisiana	3	2								5	12			17	9	8		4			1		1	23	22	63	1		64	49	87	71
Michigan	3					1	1			5	18			23	10			4		2	2		1	19	8	99			99	111	118	119
Mississippi	2									2	14		1	17		1		2		1	2			13	9	66		3	69	47	82	56
Missouri											3			3												8			8			
Montana											1		1	2	1			1						2	3	16		2	18	12	20	15
Nebraska											5			5	4			1			2			7	9	36	1	2	39	22	46	31
Nevada																													2		1
New Mexico	1	2	2	1	1		1			8	13			21	9	2	6	5	1	2	6			31	15	51	1	1	53	37	84	52
North Dakota	1						3			4				4	3						5			8		3			3	1	11	1
Ohio									2	2	3			5			1						5	6	4	14			14	10	20	14
Oklahoma	10	2		3			6			21	60			81	32	4	7	16		1	18	1		79	57	290			290	264	369	321
Pennsylvania																										2			2		2	
South Dakota																										1			1		1	
Texas	49	5	3	12	2	3	12	1	3	90	334		21	445	230	27	36	72	4	8	52	4	13	446	401	1567	6	125	1698	1424	2144	1825
Dist. 1 S. Central	3	1					2			6	25		1	32	8	2	1	1		1	2		1	16	15	125		5	130	84	146	99
Dist. 2 Middle Gulf	5	2		2			2		1	11	23			34	13	8	6	4			8	3	7	49	42	108	1	11	120	94	169	136
Dist. 3 Upper Gulf	2	1		6	1	1		1	1	13	39		5	57	13	8	3	28	2	5		1	2	62	45	138		9	147	106	209	151
Dist. 4 L. Gulf-SW	2	1		1					1	5	33		2	40	11	6	10	7	1		3		3	41	51	172	3	9	184	132	225	183
Dist. 5 E. Central											5		1	6	3									3	11	40		2	42	75	45	86
Dist. 6 Northeast	1									1	10			11	5	2		6			2			15	11	52		2	54	29	69	40
Dist. 7-B N. Cent.	19		2	1	1	2	1			26	88		2	116	77	1	9	2	1	2	2			94	89	367		5	372	365	466	454
Dist. 7-C W. Cent.	8		1	1			1			11	33			44	27			3	4		10			44	36	163		3	166	110	210	146
Dist. 8 West	4			1			5			10	38		1	49	24				10		20			54	41	163	1	3	167	158	221	199
Dist. 9 North	5						2			7	37		9	53	49			3	10		5			67	57	223	1	72	296	262	363	319
Dist. 10 Panhandle											3			3				1						1	3	16		4	20	9	21	12
Utah											3			3													1	18			18	11	18	12
West Virginia											1			1	1									1	2	2			2		3	2
Wyoming	1	1					2			4	2			6	3	2		5			2			12	17	36		1	37	41	49	58
Total U.S.	93	13	8	24	4	4	34	1	5	186	720		29	935	408	47	63	146	7	18	132	5	22	848	732	3283	9	161	3453	3057	4301	3789

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Exclusive features on Halliburton's string include: 1) The new curved J-slot that automatically locks every tool, prevents valves from opening too soon, closes and locks simply by raising drillpipe a few feet; 2) Special duty packers designed to meet various hole conditions; 3) Locked-open By-Pass; 4) Surface-controlled adjustable chokes; 5) Multi-purpose circulating valves, and other features Halliburton *alone* offers.

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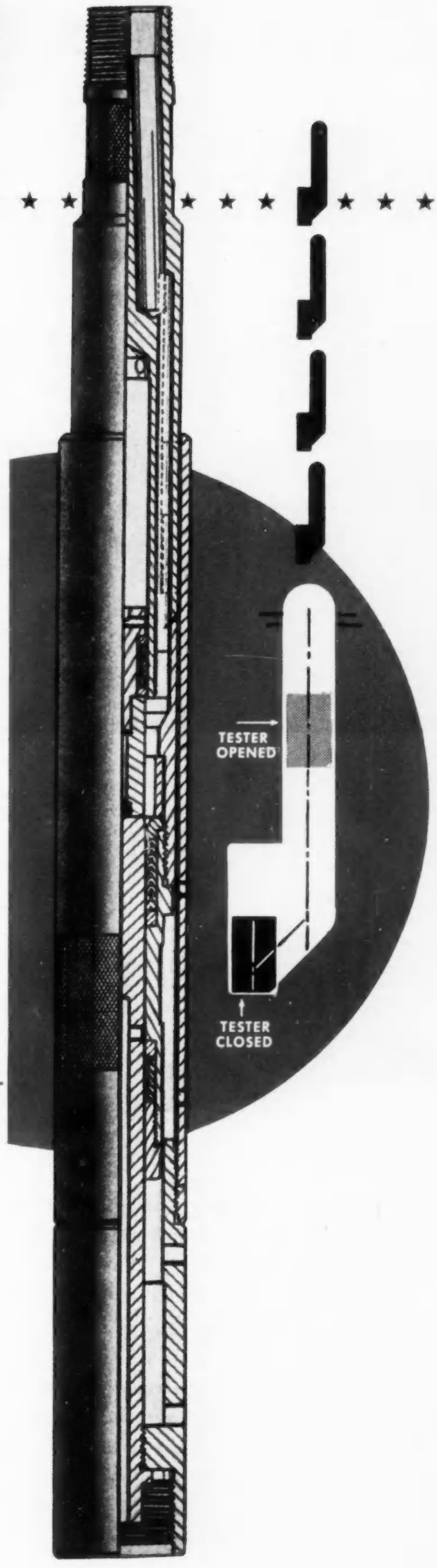

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U.S. Discoveries in May

CALIFORNIA—NEW OIL FIELDS

Kern County, "Beer Nose" field. Yellowstone Oil Company's Still Mabury 0-12-1, in 1-26s-18e, pumped 10 barrels oil and 40 barrels water from Oceanic sand, Oligocene 415-57 feet, 13.2-gravity, completed 4-29-52, TD 457.

Los Angeles County, Canoga Park area. W. J. McCarthy's Krank Knapp 1, in 4-1n-17w, pumped 6 barrels oil and 6 barrels water from 745-1123 feet, completed 4-28-52, TD 1226.

Unnamed field. Universal Consolidated Oil Corporation's Curtis 1, in 31-2s-10w, flowed 135 barrels from 4850-5288 feet, 17.3-gravity, 18/64-inch, completed 4-24-52, TD 5288.

San Benito County. W. W. Holmes, Operator's O'Connor 1, in 33-17s-9e, pumped 20 barrels from Etchegoin sand, Pliocene 1572-1937 feet, 27-gravity, completed 5-23-52, TD 1937.

CALIFORNIA—NEW OIL PAYS

Fresno County, Coalinga, East field. Los Nietos Company et al's 18F-86V, NE SE 18-20s-16e, flowed 520 barrels from Vaqueros sand, Miocene 6383-6445 feet, 38-gravity, 19/64-inch, completed 5-12-52, TD 6449.

Kern County, Devils Den field. Gilliland Oil Company & C. O. Davis' Alferitz 12, in 14-25s-18e, pumped 60 barrels from Point of Rocks sand, Eocene 1353-1450 feet, 18.2-gravity, completed 5-10-52, TD 2200.

Ventura County, Torrey Canyon field. Union Oil Company's Torrey 83, in 5-3n-18w, pumped 515 barrels from Sespe sand, Oligocene 7725-9326 feet, 18.4-gravity, completed 5-2-52, TD 9327.

CALIFORNIA—OIL FIELD EXTENSIONS

Monterey County, San Ardo field. Standard Oil Company's Alexander 14-B-5, in 5-23s-11e, ½-mile east extension, pumped 44 barrels oil and 10 barrels water from Orradre sand, Miocene 2489-2618 feet, completed 4-19-52, TD 2618.

San Luis Obispo County, Guadalupe field. Thornbury Drilling Company's LeRoy I-3, in 1-10n-36w, ½-mile extension, pumped 70 barrels from Foxen sand, Pliocene 2730-2818 feet, 12-gravity, completed 4-11-52, TD 2818.

COLORADO—NEW OIL FIELDS

Adams County, Middlemist field. Roden, Darden & McRae's Middlemist 1, NE NE SW 20-3s-57w, pumped & flowed 92 barrels from "J" sand, Cretaceous 5516-20 feet, completed 5-3-52, TD 5930.

Noonen Ranch field. Ginter, Warren & Ginther's Michael E. Noonen 1, NE SW NW 24-3s-59w, pumped 10 barrels oil and 15 barrels water from Muddy "J" sand, Cretaceous 6193-6248 feet, TD 6600.

Morgan County, Messer field. S. D. Johnson's Cnockaert 1, NE NE NW 6-5n-56w, pumped 62 barrels oil and 100 barrels water from "J" sand, Cretaceous 5862-63 feet, TD 5893.

COLORADO—OIL FIELD EXTENSION

Washington County, Little Beaver Creek field. Tucker & Snowden's Hubbard 1, SE SW NW 6-2s-56w, ½-mile southeast extension, flowed 60 barrels from Muddy sand, Upper Cretaceous 5252-58 feet, TD 5342.

COLORADO—NEW GAS FIELD

Sedgewick County. Stanolind Oil & Gas Company's Susannah Franklin 1, C SE SE 35-12n-44w, flowed 7 million from Upper Muddy "D" sand, Cretaceous 3182-3200 feet, completed 5-6-52, TD 3541.

ILLINOIS—NEW OIL FIELDS

Lawrence County, Ruark, West field. Coy Oil Company's W. M. Prout 1, SE SE SW 12-2n-13w, pumped 217 barrels from Lower O'Hara lime, Mississippian 2386-91 feet, completed 6-3-52, TD 2438.

White County, Crossville, West field. W. O. Lucas' S. A. Goodman 1, old well worked over, NW SE SW 22-4s-10e, pumped 15 barrels oil and 15 barrels water from Aux Vases sand, Mississippian 3029-37 feet, completed 5-20-52, TD 3230.

ILLINOIS—NEW OIL PAY

Marion County, Brown field. T. M. Pruett's Morris-Frazier Comm. 1, old well worked over, NW SW SW 16-1n-1e, pumped 8 barrels from Petro sand,

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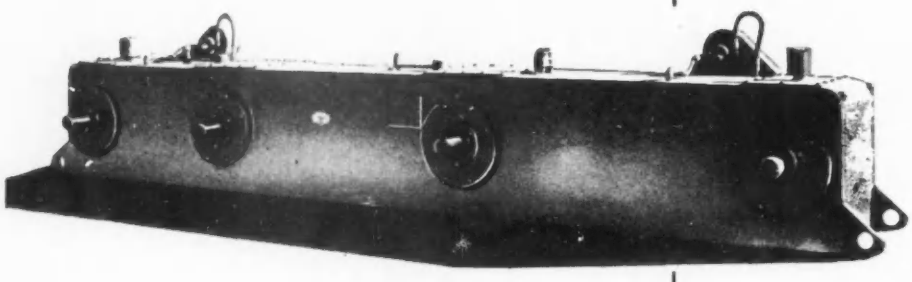

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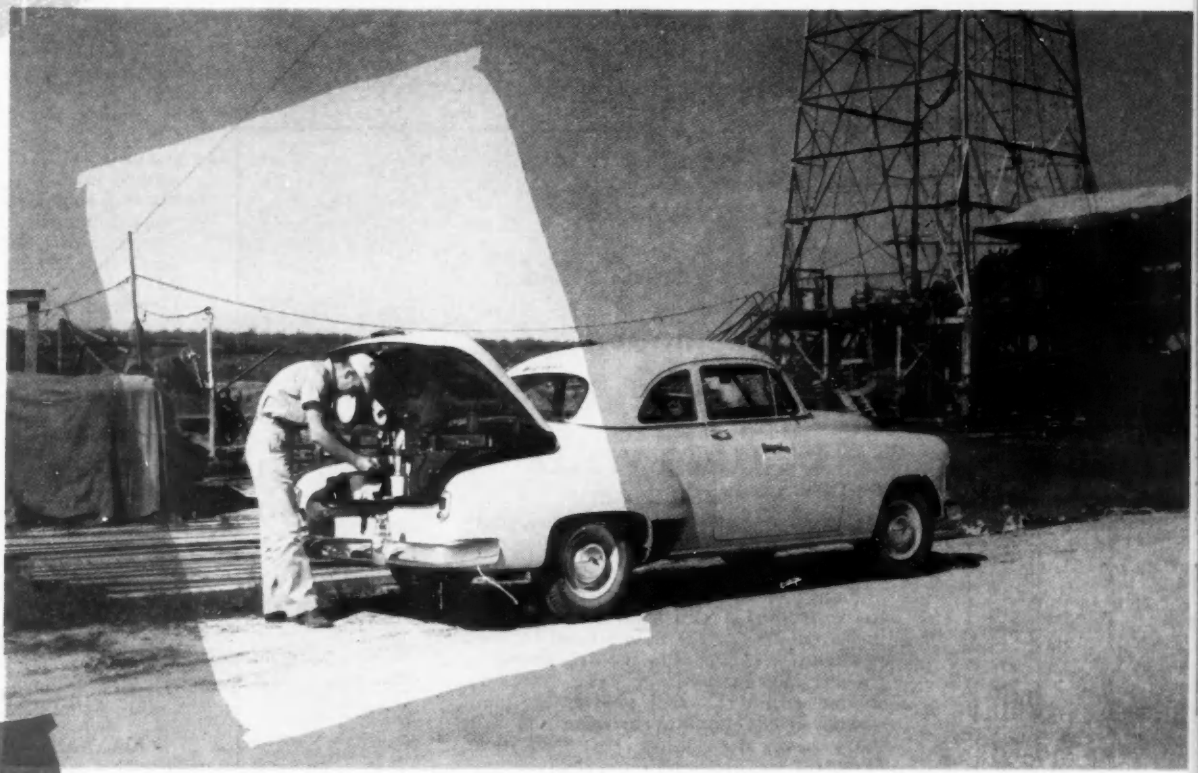

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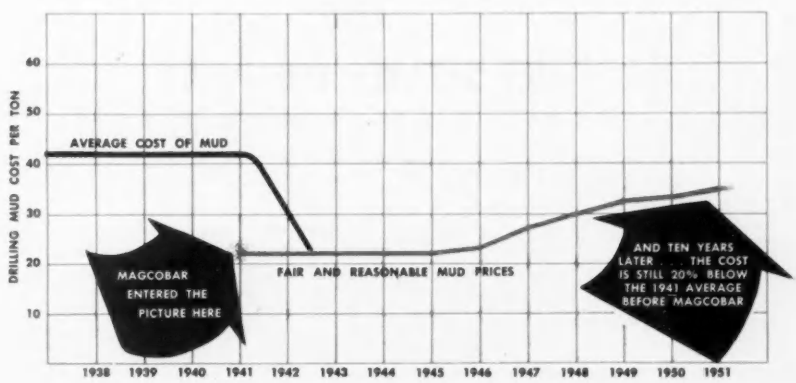
DRILLING MUD COST PER TON
60
50
40
30
20
10
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1938 1939 1940 1941 1942 1943 1944 1945 1946 1947 1948 1949 1950 1951

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Pennsylvanian 843-850 feet, completed 5-6-52, TD 850.

ILLINOIS—OIL FIELD EXTENSIONS

Wabash County, Allendale field. Calvert Drilling Company's Crowell 1, NE SW NE 24-1n-13w, ½-mile extension, pumped 35 barrels from Biehl sand, Pennsylvanian 1598-1607 feet, completed 5-27-52, TD 1610.

New Harmony Consolidated field. Calvert Drilling's M. W. Kleinschmidt 1, NE SE SW 23-2s-14w, ¾-mile extension, pumped 10 barrels oil and 150 barrels water from McClosky lime, Mississippian 2925-30 feet, completed 5-27-52, TD 3019.

Wayne County, Ellery West field. Stanford Oil Company's A. E. Seifert 1, NE NE NE 35-2s-9e, ½-mile south extension, pumped 130 barrels from Bethel sand, Mississippian 3103-10 feet, completed 5-13-52, TD 3383.

Ellery, West field. Indiana Farm Bureau's N. Duke 1, NW NE SE 14-2s-9e, 1-mile north extension, pumped 77 barrels from McClosky lime, Mississippian 3392-3400 feet, completed 5-13-52, TD 3460.

White County, Trumbull field. E. A. Obering's Scott 1, SW SE NW 12-5s-8e, 1¼-mile west extension, pumped 27 barrels oil and 54 barrels water from McClosky lime, Mississippian 3358-64 feet, completed 6-5-52, TD 3367.

INDIANA—OIL FIELD EXTENSION

Gibson County, Owensville field. C. E. O'Neal, J. Buchman, Aubrey & Tennant's C. B. Smith, V. Baird et al 1, SE SE SE 24-3s-12w, ½-mile extension, pumped 195 barrels from O'Hara lime, Mississippian 2510-26 feet, completed 5-22-52, TD 2614.

KANSAS—NEW OIL FIELDS

Barton County. Ben Brack Drilling Company's Alefs 1, NW SW SW 14-19s-14w, pumped 30 barrels from Lansing-K. C. lime, Pennsylvanian 3212-33 feet, TD 3485.

Cowley County, Arkansas City, West field. Aylward Drilling Company's Land & Power 1, SW SW SW 23-34s-3e, pumped 58 barrels from Mississippi lime, Mississippian 3329-50 feet, TD 3350.

Decatur County. Continental Oil Company's Feely 1, SE SE SW 2-5s-27w, pumped 784 barrels from Lansing-K. C. lime, Pennsylvanian 3590-3604 feet, TD 4040.

Ellis County, Ginther field. N. C. R. A.'s Ginther 1, NE NE SW 17-11s-19w, pumped 111 barrels from Arbuckle lime, Ordovician 3554-58 feet, TD 3558.

Graham County. Bay Petroleum Corporation's Schmied 1, NW NW SW 21-8s-25w, pumped 68 barrels from Lansing-K. C. lime, Pennsylvanian 3740-44 feet, TD 4474.

Unnamed field. Petroleum, Inc.'s White 1, NW NW NW 25-10s-21w, pumped 154 barrels from Arbuckle lime, Ordovician 3715-21 feet, TD 3721.

Rooks County, Lynd, Southwest field. L. B. Stableford and K & E Drilling Company's Mabel Suter 1, SE SW SE 5-10s-19w, pumped 80 barrels from Arbuckle lime, Odrovician 3759-63 feet, TD 3763.

Stafford County, Hudson field. B&B Drilling Company's Dohrmann 1, NE NE SW 33-22s-12w, pumped 334 barrels from Lansing-K. C. lime, Pennsylvanian 3490-3500 feet, TD 3688.

Oscar, West field. Imperial Petroleum Company, Inc.'s Pritchard 1-A, NW NW NE 22-22s-14w, flowed 1060 barrels from Lansing-K. C. lime, Pennsylvanian 3593-3601 feet, TD 3876.

KANSAS—NEW OIL PAYS

Ellsworth County, Heiken field. Skelly Oil Company's Stumps 1-A, SW SW SE 25-17s-10w, pumped 50 barrels from Lansing-K. C. lime, Pennsylvanian 2974-2982 feet, TD 3267.

Rice County, IXL, South field. Skiles Oil Company's Boldt 2, C E½ NW NE 9-19s-10w, pumped 427 barrels from Arbuckle lime, Ordovician 3335-3341 feet, TD 3350.

KANSAS—NEW GAS FIELD

Meade County. Columbian Fuel Corporation's Adams 2-G, C NE NE 7-35s-29w, flowed 5.2 million from Marmaton lime, Pennsylvanian 5780-94 feet, TD 6237.

KENTUCKY—NEW OIL FIELDS

Daviess County, Sun Oil Company's D. L. Byrne 1, in 14-0-26, pumped 40 barrels from Benoist sand, Mississippian 1988-2000 feet, TD 2000.

Henderson County. Stanford Oil's Edgar McMullin 1, in 17-0-24, pumped 90 barrels from Benoist sand Mississippian 2312-21 feet, TD 2632.

McLean County. Dr. H. E. Lopp-Thurston Cooke's T. A. Ellis 1, in 9-L-26, pumped 60 barrels from O'Hara lime, Mississippian 2638-44 feet, TD 2644.

KENTUCKY—NEW OIL PAY

McLean County, Barrett Hill field. Ralph Halbert & William D. Jennings' Ethel Polk 1, in 7-M-30, pumped 72 barrels from Tar Springs sand, Mississippian 1432-49 feet, TD 1449.

FIG. 1

JET controlled

Circulation

for

DRILLING WELLS

Circulation control has long been a problem in oil well drilling and the deeper wells go, the bigger the problem.

Fluid Control and Jet Service Company has developed a new method of dividing the circulation of the fluid stream between any number of points in the drill string by transferring energy and fluid from the stream within the drill pipe to the fluid stream in the annulus between the drill string and the casing, or open hole. (Fig. 1.)

The fluid control valves (Fig. 2 showing jet ports closed and Fig. 3 with jet ports open) are hydrostatically controlled by pump pressure. The driller can alter hydrostatic pressure at one or more depths as he desires.

Bottom hole pressure can be decreased by increasing pump pressure and **at the same time** increase fluid velocity.

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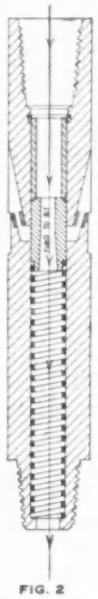
FIG. 2

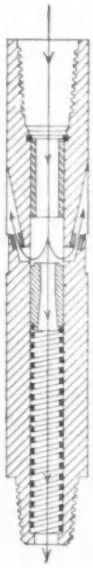
FIG. 3

Security CASING SCRAPER

- ***FIRST*** **to operate with rotary or vertical motion while going in or coming out of the hole**
- ***FIRST*** **to cut to exact inside diameter**
- ***FIRST*** **to positively clean every inch of casing**

Cutters of Security Casing Scrapers have helical teeth for positive shearing action and are expanded to full inside diameter by spring pressure. Cutters contact entire casing circumference at all times.

Security Casing Scrapers quickly and easily remove obstructions inside casing – such as scale, gun perforation burrs, or cement sheaths resulting from cementing operations.

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NORTH LOUISIANA—NEW OIL FIELDS

DeSoto Parish, "Grand Cane, North" field. The Texas Company's A. J. Gamble 1, C NE SW 19-13n-14w, pumped 33 barrels oil and 33 barrels water from Paluxy sand, Lower Cretaceous 4218-24 feet, 33.3-gravity, completed 5-11-52, TD 7175.

Union Parish, Shell Oil Company's Robert L. Andrews 1, in 34-23n-2e, pumped 4 barrels from Cotton Valley sand, Jurassic 5514-19 feet, completed 5-17-52, TD 8235.

NORTH LOUISIANA—NEW OIL PAY

Caddo Parish, Pine Island field. Gulf Refining Company's Caddo Levee Board N-281, in 22-20n-16w, pumped 10 barrels from Pettit lime, Lower Cretaceous 5242-76 feet, completed 5-24-52, TD 8232.

NORTH LOUISIANA—NEW DISTILLATE FIELD

Ouachita Parish, Swartz field, Feazel Interests and Monla Gas Co. Inc.'s Breece Lumber Co. 1, in 3-18n-5e, flowed 175 barrels distillate and 25 million from Bodcaw sand, Jurassic 7343-69 feet, 64.7-gravity, open, completed 5-29-52, TD 7981.

NORTH LOUISIANA—NEW DISTILLATE PAY

Bossier Parish, Sligo field. Natural Gas & Oil Corporation & C. H. Murphy's U. S. A. 2, C SE 12-17n-12w, flowed 40 barrels distillate and 3.7 million from Cotton Valley "D" sand, Jurassic 7910-24 feet, 22/64-inch, and 3.9 million dry gas from Travis Peak sand, Lower Cretaceous 6160-6219 feet, 18/64-inch, completed 2-1-52, TD 8370.

SOUTH LOUISIANA—NEW OIL FIELDS

Allen Parish, Shell's J. A. Bel 1, C SE NE 5-6s-3w, flowed 40 barrels from 5891-93 feet, completed 5-5-52, TD 6405.

Livingston Parish. Progress Petroleum Company's Juban 1 in 4-7s-3e, flowed 130 barrels from 8591-97 feet, 50-gravity, 9/64-inch, completed 5-21-52, TD 9013.

Plaquemines Parish, Potash area. Woods Oil & Gas Company's Dr. B. R. Slater 1, in 6-18s-27e, flowed 80 barrels from 11,230-241 feet, 42.5-gravity, 10/64-inch, completed 5-16-52, TD 11,337.

SOUTH LOUISIANA—NEW DISTILLATE FIELDS

Cameron Parish. Superior Oil Company's Rockefeller-State Lease 2038-1, in 4-16s-3w, flowed 94 barrels distillate and 7.8 million from Miocene 11,242-250 feet, 47.4-gravity, 22/64-inch, completed 5-15-52, TD 12,030.

Terrebonne Parish. Union Production Company & Texas Gulf Production Company's La Terre Co. Inc. 1-C, in 109-20s-18e, flowed 144 barrels distillate and 5.5 million from 14,148-156 feet, 46.8-gravity, completed 5-4-52, TD 14,690.

MICHIGAN—NEW OIL FIELDS

Allegan County. Louis Zellman's Walker 1, NE SE SE 13-1n-13w, pumped 3 barrels from Traverse lime, Devonian 1175-1177 feet, TD 1177.

Clare County. Sun Oil Company's Iutzi et al 1, NW SW SW 5-19n-3w, flowed 100 barrels from Richfield sand, Devonian 5133-5213 feet, TD 5380.

Otsego County. Brazos Oil & Gas Company's State-Chester HE-1, C NE NE 15-29n-2w, pumped 15 barrels from Basal Salina dolomite, Silurian 6538-50 & 6606-38 feet, TD 6712.

MICHIGAN—OIL FIELD EXTENSION

Ogemaw County, Rose City field. Brazos' State-Foster BBB-5, N½ NW SE 21-24n-1e, 2-mile northwest extension, flowed 226 barrels from Richfield sand, Devonian 4178-4294 feet, TD 4294.

MICHIGAN—NEW GAS PAY

Clare County, Unnamed field. Sun's Iutzi-Woods et al Unit 1, C SE 6-19n-3w, flowed 9.6 million from Marshall sand, Mississippian 1469-81 feet, TD 1481.

MISSISSIPPI—NEW OIL FIELDS

Jefferson County, "Sunnyside" field. J. Willis Hughes' John S. Logan & A. B. Shields 1, in 20-8n-1w, flowed 82 barrels from Wilcox sand, Eocene 4163-64 feet, 29-gravity, 10/64-inch, completed 5-14-52, TD 6552.

Wilkinson County, "Wilkinson" field. Gulf Refining's Crosby Lumber Manufacturing Co. et al 5, in 23-3n-2w, flowed 67 barrels from Wilcox sand, Eocene 7160-66 feet, 34.5-gravity, 9/64-inch, completed 5-6-52, TD 7564.

NEW MEXICO—NEW OIL FIELD

Lea County. Wilshire Oil Company's Townsend 1, in 4-16s-35e, flowed 263 barrels from Wolfcamp lime, Permian 10,410-500 feet, 40.5-gravity, ½-inch, completed 5-12-52, TD 13,803.

NEW MEXICO—NEW OIL PAY

Lea County, Corbin field. Barney Cockburn's Corbin 5-A, in 9-18s-33e, pumped 12 barrels from Yates sand, Permia 3443-59 feet, 36.5-gravity, completed 4-25-52, TD 4305.

"On the highway I like a safe and reasonable speed — not going like a cat with a firecracker on his tail! But on a rig, I speed up on round trips to save days by using Foster Catheads.

"The driller operates Foster Catheads from his regular position; there's no time lost waiting for the shaft to slow down because powerful friction clutches engage — without shock — while the cathead shaft is running at high speed."

Among Foster's other "Catheads for every need" are the Air Master Breakout, the Air Spinning, the Midget Master Breakout, and the Midget Spinning Catheads.

Equip your Foster friction catheads with the new Foster Safety Rope Guard. Inexpensive and easy to install.

Foster Spinning Cathead
SPEED . . . instant engagement without reducing lineshaft speed.
ECONOMICAL . . . will spin and tong with forked line.
DEPENDABLE . . . heavy bearings, well lubricated . . . records of years of operation without repairs.
SAFETY . . . eliminates hand-wrapping of spinning line.

Foster Master, Type B, Breakout Cathead
SPEED . . . instant engagement without reducing lineshaft speed.
ECONOMICAL . . . no metal-to-metal impacts . . . no complicated brake necessary.
DEPENDABLE . . . powerful friction clutch . . . roller bearings.
FLEXIBLE . . . recommended for either air or manual controls.

Our years of experience assure you years of satisfaction.

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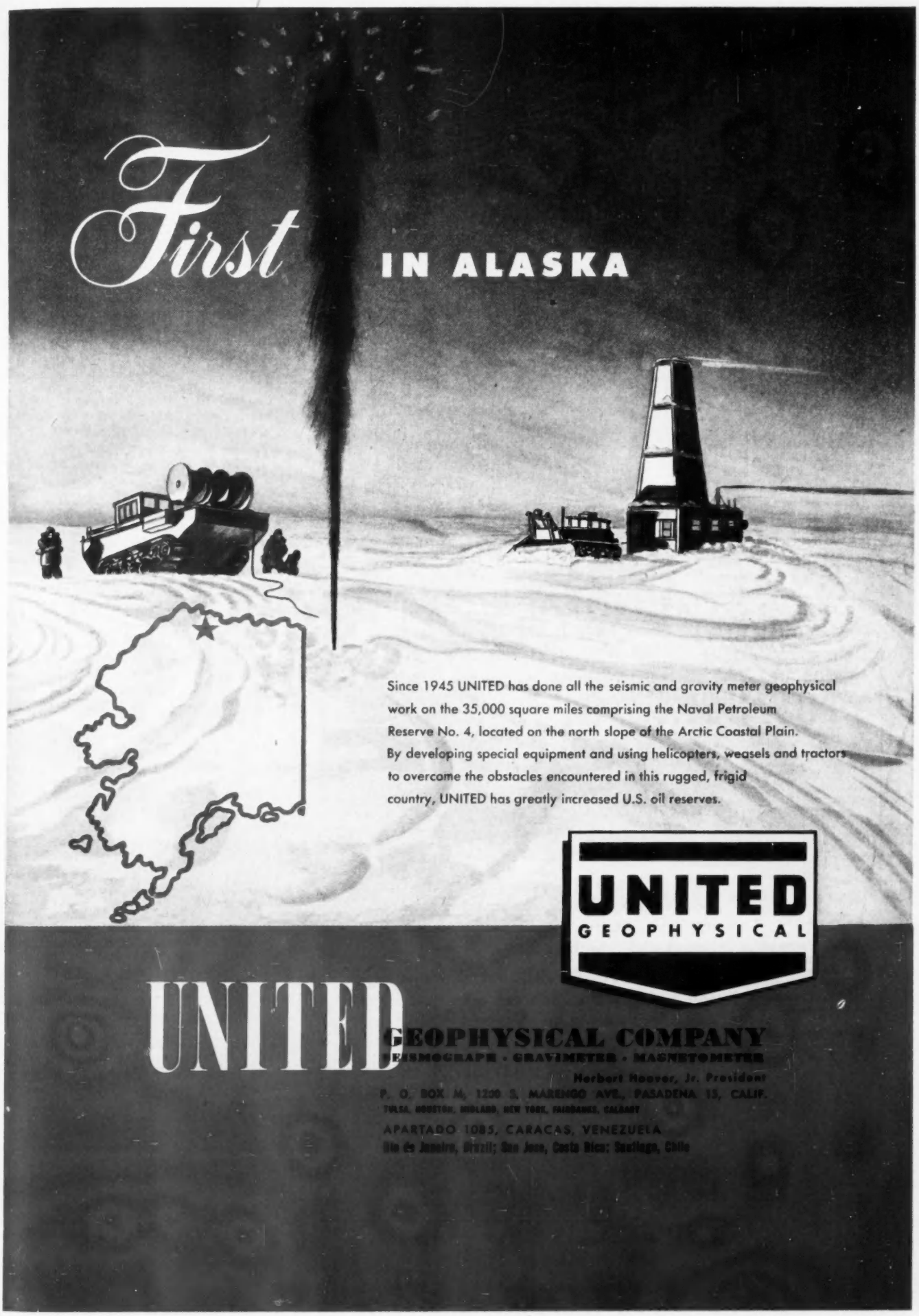
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NEW MEXICO—OIL FIELD EXTENSION

Lea County, Echols field. The Texas Company's State NCT-2 1-AW, in 21-10s-37e, 2½-mile northeast extension, flowed 899 barrels from Devonian lime 12,057,-073 feet, 40-gravity, 1/8-inch, completed 5-5-52, TD 12,140.

NEW MEXICO—NEW DISTILLATE FIELDS

Eddy County. Continental Oil Company's Gertrude Duffield 1, in 21-16s-27e, flowed 30 barrels distillate and 3.8 million from Mississippian sand 8616-47 and 8690-8715 feet, 66.5-gravity, 1½-inch, completed 5-13-52, TD 10,188.

Lea County. Humble Oil & Refining Company's Federal-Elliott 1, in 1-16s-34e, flowed 257 barrels distillate and 4.5 million from Lower Pennsylvanian sand 12,880-13,175 feet, 51-gravity, 3/4-inch, completed 5-8-52, TD 14,763.

NEW MEXICO—NEW DISTILLATE PAY

Lea County, Hare field. Continental's A. M. Lockart "A-27" 1-T, in 27-21s-37e, flowed 274 barrels distillate and 5.2 million from Tubb sand, Permian 6115-6205 feet, open, completed 5-1-52, TD 7615.

NEW MEXICO—NEW GAS FIELDS

Rio Arriba County. Barron-Kidd's Abraham 1, NW NW SW 27-30n-6w, flowed 5 million from Mesaverde sand, Upper Cretaceous 5300-6070 feet, completed 5-12-52, TD 6191.

Unnamed field. El Paso Natural Gas Company's Harrington 1, in 4-27n-5w, flowed 5.4 million from Dakota sand, Upper Cretaceous 7754-7881 feet, completed 5-21-52, TD 7881.

NORTH DAKOTA—NEW OIL FIELD

McKenzie County. Amerada Petroleum Company's Ben Homer Risser, 1, C SW SE 12-149n-96w, flowed 280 barrels oil and 68 barrels water from Madison lime, Mississippian 9515-70 feet, ½-inch, TD 13,773.

NORTH DAKOTA—OIL FIELD EXTENSIONS

Williams County, Beaver Lodge field. Amerada's Palmer H. Dilland 1, C SW NE 31-156n-95w, 1½-mile northeast extension, flowed 515 barrels from Madison lime, Mississippian 8550-90 feet, 43-gravity, ¼-inch, TD 13,325.

Beaver Lodge field. M. B. Rudman, American Viking & Tioga Petroleum's Math Iverson 1, C NE NW 18-155n-95w, 1-mile south extension, flowed 596 barrels from Mission Canyon (Madison) lime, Mississippian 8570-90 feet, 45.5-gravity, ¼-inch, completed 4-28-52, TD 12,000.

Beaver Lodge, Northeast field. Amerada's Peter Larson 1, C SE NW 14-156n-95w, 1½-mile extension, flowed 416 barrels from Madison lime, Mississippian 8512-40 feet, 40.5-gravity, ¼-inch, completed 5-21-52, TD 8573.

OHIO—GAS FIELD EXTENSIONS

Hocking County, Union Furnace field. Waverly Oil Works Company's H. L. Hockman 1, NE SE Section 31, Starr Township, 2-mile south extension, flowed 0.4 million from Clinton sand, Silurian 3068-86 feet, completed 5-2-52, TD 3104.

Meigs County, Putnam field. B. H. Putnam et al's Russell Randolph 1, Section 11, Olive Township, 4-mile south extension, flowed 0.2 million from Oriskany sand, Devonian 4220-40 feet, completed 5-26-52.

OKLAHOMA—NEW OIL FIELDS

Garvin County. Phillips Petroleum Company's Denson 1, SW SW SW 18-3n-3w, flowed 163 barrels from Hart sand, Pennsylvania 8586-8632 feet 42-gravity, 11/64-inch, and was not gauged from Springer sand, Pennsylvanian 9487-9557 feet, TD 10,510.

Grant County. O. J. Perren's Bentley 1, in 20-25n-5w, pumped 3 barrels oil and 3 barrels water from Marshall sand, Ordovician 6010-16 feet, 50-gravity, TD 6079.

Hughes County. Harry H. Diamond, Inc. et al's Spillman 2, NE NE NE 20-7n-9e, pumped 3 barrels oil and 15 barrels water from Booch sand, Pennsylvanian 2954-70 feet, TD 4140.

Unnamed field. Poteet & Wysor's Dailey 1, NW SE NW 20-7n-9e, pumped 5 barrels oil and 10 barrels water from Calvin sand, Pennsylvanian 940-55 feet, 30-gravity, TD 955.

Lincoln County, Merrick, North field. Jon Carson's Jones 1, SW SW NW 7-16n-2e, pumped 65 barrels from Red Fork sand, Pennsylvanian 4624-30 feet, 38-gravity, TD 4650.

Payson, East field. Gulf Oil Corporation's Henthorn Estate 1, NE NW NE 1-12n-4e, flowed 195 barrels from Lower Skinner sand, Pennsylvanian 4095-97 feet, 38-gravity, open, TD 5390.

Logan County, Guthrie Lake, East. Davidor & Davidor's Harned 1, NE SE SE 4-15n-3w, flowed 242 barrels from Bartlesville sand, Pennsylvanian 5880-83 feet, 46-gravity, ½-inch, TD 6148.

McClain County, Washington, East field. Woodward & Company and Mendota Oil Company's Ecie May Conner 1, NE SE SW 11-7n-3w, flowed 720 barrels from Bromide sand, Ordovician

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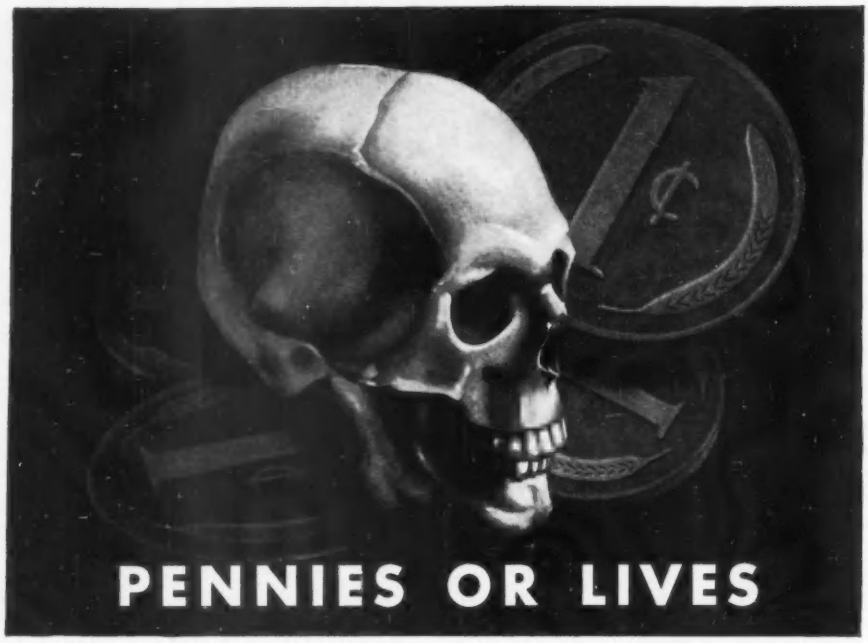

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The latch locks the load. It cannot open until released by the operator. And it's made of pressed steel or bronze with a stainless steel spring that won't rust or weaken. The cam is an integral part of the hook forging for extra strength.

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9236-96 feet, 39.3-gravity, 5/16-inch, and 264 barrels from Joins sand, Ordovician 10,053-88 feet, 39.1-gravity, ½-inch, TD 10,206.

Noble County, Lone Elm, South field. Wilcox Oil Company's Carl 1, NE NE SW 17-20n-1e, pumped 95 barrels from Lower Cleveland sand, Pennsylvanian 4215-26 feet, 41.5-gravity, TD 4828.

Okmulgee County, Nature, East field. J. W. Gallagher's McInturff 1, SW SW NE 10-15n-13e, flowed 20 barrels from 1793-1806 feet, 32-gravity, TD 1807.

OKLAHOMA—NEW OIL PAYS

Carter County, Lone Grove, Northeast field. Sinclair Oil & Gas Company's W. J. Brown 1, C SW NW 20-4s-1e, flowed 204 barrels from Lower Dornick Hills sand, Pennsylvanian 5624-66 feet, 39.4-gravity, 3/4-inch, TD 5713.

Comanche County, Hanbury field. William H. Atkinson's Walter J. Blumenshine 1, NE NE NE 12-2n-10w, pumped 21 barrels from Granite Wash 2352-67 feet, 45-gravity, TD 3316.

Garvin County, Eola field. Sohio Petroleum Company's Henthorne 1, SE NW SE 7-1n-2w, flowed 527 barrels from McLish sand, Ordovician 8744-51 feet, 35.9-gravity, ½-inch, TD 8897.

OKLAHOMA—OIL FIELD EXTENSIONS

Grant County, Rich Valley field. Oras A. Shaw's Luvern Hays 1, SW SE NW 36-26n-5w, northwest extension flowed 480 barrels from Marshall sand, Ordovician 5804-20 feet, 45.4-gravity, 5/16-inch, TD 5825.

Okfuskee County, Arno, Southeast field. Jones-Shelburne & Wm. G. Johnston's Todie Johnston 1, NE SE NE 5-13n-8e, southeast extension flowed 50 barrels from Cromwell sand, Pennsylvanian 3427-37 feet, 39-gravity, ⅜-inch, TD 3438.

Okfuskee County, Micawber, Southwest field. Harper-Turner Drilling Company's Harjo 1, NW NW NW 7-13n-8e, east extension, pumped 10 barrels oil and 15 barrels water from Prue sand, Pennsylvanian 2466-72 feet, TD 3513.

Oklahoma County, Edmund, Northeast field. Sterling Oil Company of Okla's Stephens 1, SE SE NW 31-14n-2w, south extension, flowed 352 barrels from Bartlesville sand, Pennsylvanian 5989-6001 feet, ½-inch, TD 6001.

Osage County, Naval Reserve field. Frank Buttram's Osage 1, NE SE SW 23-24n-7e, ½-mile south extension, pumped 24 barrels from Burbank sand, Pennsylvanian 2413-2578 feet, TD 2578.

Osage County, Wildhorse field. Charles W. Oliphant's Osage 1, SW NE NE 12-22n-10e, north extension, pumped 125 barrels from Bartlesville sand, Pennsylvanian 1701-27 feet, TD 1754.

OKLAHOMA—NEW DISTILLATE FIELDS

Beaver County, Knowles, Northwest field. Pure Oil Company's M. J. Albert 1, SE SE SW 16-5n-26e, flowed distillate and 2.1 million from Morrow sand, Pennsylvanian 6028-38 feet, TD 9233.

Harper County, Laverne, South field. Sunray Oil Corporation's E. M. Wolfe 1, C NW NE 4-25n-25w, flowed 47 barrels distillate and 5.2 million from Morrow sand, Pennsylvanian 7190-7230 feet, 68.2-gravity, 1-inch, TD 8245.

TEXAS DISTRICT 1—NEW OIL FIELDS

Atascosa County. Lone Star Producing Company's Mrs. Juan Leal 1, J. A.

was buried since 1912

It's still in top notch condition

— still 100% re-usable!

■ This latest story came to our attention late last year: An oil and gas producer in Ohio bought an old well (drilled in 1912 to a depth of 5300 feet) to be plugged and abandoned according to state regulations. When he pulled the well, intending to sell the casing for scrap, he was surprised to find it practically as good as new, in fact the original National Tube mill stencil was still showing on about half the lengths.

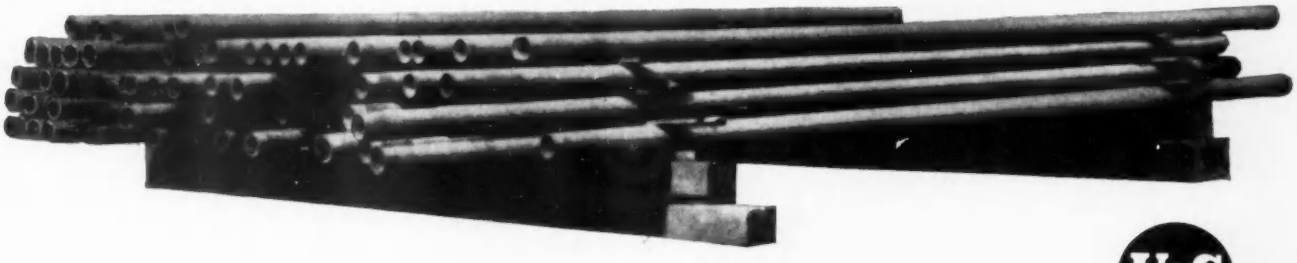
The couplings on all 3500 feet of this casing were in excellent condition. The *threads* on both the pipe and the couplings were clean and sharp; so was the knurling, with no sign of rust or galling.

After careful examination, this near 40-year old casing has been pronounced sound and usable, and instead of being scrapped will be re-used.

We at National Tube are pleased by performance like this, because it tells better than words, that when you use U·S·S National Drill Pipe, Casing or Tubing, you get products that promise long, dependable service.

U·S·S National Drill Pipe, Casing and Tubing have long been distinguished for enduring quality. Throughout the years they have been continually improved by better steels, better heat treating, better fabricating methods, and better thread construction, so that today oil country tubular products bearing the name NATIONAL are still setting new standards for dependability and long time service.

Of course you don't buy casing to pull after 40 years in the ground, but service like this shows that when you *do* buy National you get an extra margin of dependability. So when you plan for future drilling operations, be sure you get the latest information on the performance of National Drill Pipe, Casing and Tubing.



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UNITED STATES STEEL

Gutierrez Survey, flowed 184 barrels from Edwards lime, Lower Cretaceous 8142-53 feet, 60.1-gravity, ¼-inch, completed 4-28-52, TD 8195.

Unnamed field. M & S Rosner's Nellie Dinamoor 1, Section 238, John Bryan Survey, pumped 84 barrels from Carrizo sand, Eocene 2075-77 feet, 18.5-gravity completed 5-22-52, TD 2085.

Guadalupe County. Traders Oil Company of Houston's C. Chase 1, H. R. Hunt Survey, flowed 170 barrels from Austin chalk, Upper Cretaceous 2300-20 feet, 37-gravity, ½-inch, completed 5-6-52, TD 2320.

TEXAS DISTRICT 1—OIL FIELD EXTENSIONS

Frio County, Pearsall field. Midstates Oil Corporation's A. E. Malone 1, W. H. Barnes Survey, southeast extension, flowed 171 barrels 30.1-gravity through ¼-inch, completed 5-19-52, TD 5870.

Wilson County, Higgins-Borrego field. M. L. Wise et al's Hayden 1, David F. Webb Survey, ⅞-mile northeast extension, pumped 194 barrels from buda lime, Lower Cretaceous 5723-90 feet, 25.5-gravity, completed 5-1-52, TD 5906.

TEXAS DISTRICT 1—NEW DISTILLATE FIELD

Bee County. Stanolind's J. H. Andrews 1, A. Jackson Davis & James G. Morrow Survey, flowed 247 barrels distillate and 11.3 million from Wilcox (Slick) sand, Eocene 7354-64 feet, 56-gravity, open, completed 5-1-52, TD 9020.

TEXAS DISTRICT 2—NEW OIL FIELDS

Dewitt County. Kirkwood & Morgan's W. A. Bell 1, F. R. McConnell Survey, flowed 130 barrels from Wilcox sand, Eocene 7959-60 feet, 33.4-gravity, ¼-inch, completed 5-19-52, TD 8115.

Jackson County. Sam G. Harrison's W. E. Boehm 1, John Davis Survey, flowed 32 barrels from Lower Frio sand, Oligocene 6319-24 feet, 10/64-inch, completed 5-4-52, TD 6765.

Unnamed field. Sohio Petroleum Corporation's L. M. Nyegaard 3, Francis Menefee Survey, flowed 153 barrels from Frio-Vicksburg sand, Oligocene 6597-6600 feet, 44.1-gravity, ⅛-inch, completed 5-6-52, TD 6772.

Refugio County. Fred W. Shield's John N. Mitchell et al 1, Isabella O'Brien Survey, flowed 69 barrels from Frio sand, Oligocene 4783-87 feet, 38-gravity, 10/64-inch, completed 5-30-52, TD 4820.

Tivoli field. Southern Minerals Corporation's Edwin Keller 1, Joshua Davis Survey, flowed 43 barrels from Frio sand, Oligocene 5075-77 feet, 44.5-gravity, 7/64-inch, completed 5-16-52, TD 5080.

TEXAS DISTRICT 2—NEW OIL PAYS

Bee County, Goree field. Skelly Oil Company's Alma Knight 1, Thomas B. Barton Survey, flowed 65 barrels from Frio sand, Oligocene 2566-80 feet, 23.2-gravity, 9/64-inch, 5-28-52, TD 7604.

Refugio County, Tivoli field. Southern Minerals' Edwin Keller 2, Joshua Davis Survey, flowed 52 barrels from 5212-16 feet, 36.6-gravity, 7/64-inch, completed 5-24-52, TD 5216.

TEXAS DISTRICT 2—OIL FIELD EXTENSION

Bee County, Cannan field. Fred W. Shield's J. C. Harris 1, Charles B. Shain Survey, 8/10-mile northeast extension, flowed 65 barrels from Slick sand, Eocene 6775-77 feet, 9/64-inch, completed 5-19-52, TD 6778.

TEXAS DISTRICT 2—NEW DISTILLATE FIELDS

Karnes County, "Pargman" field. Brazos Oil & Gas' Rudolph Kruse 1, Victor Blanco Survey, flowed 99 barrels distillate and 3.2 million from 7208-14 feet, 60-gravity, open, completed 4-3-52, TD 7521.

Lavaca County. Alex Head's Stella Woytek et al. 1, old well drilled deeper, James Campbell Survey, flowed 125 barrels distillate and 9 million from Wilcox sand, Eocene, open, completed 5-2-52, TD 9212.

TEXAS DISTRICT 2—GAS FIELD EXTENSION

Refugio County, O'Connor-McFaddin field. T-C Oil Company's O'Connor 7-B, Florentine Rios Survey, ¾-mile southeast extension, flowed 128 million from Catahoula sand, Oligocene 2256-66 feet, open, completed 4-5-52, TD 2985.

TEXAS DISTRICT 3—NEW OIL FIELDS

Fayette County. Sutton Drilling Company's E. A. Arnim 2, William Kuykendall Survey, flowed 81 barrels from Arnim "A" sand, Eocene 2150-55 feet, 23-gravity, 18/64-inch, completed 4-29-52, TD 2210.

Jasper County, West Castillo field, American Republics Corporation & Houston Oil Company's W. A. Fletcher Fee 1, W. A. Fletcher Survey, flowed 69 barrels from Yegua No. 12 sand, Eocene 7620-22 feet, 44.8-gravity, 6/64-inch, completed 5-17-52, TD 8152.

TEXAS DISTRICT 3—NEW OIL PAYS

Brazoria County, Danbury Dome field. Johnny Mitchell's A. B. Mayes 1, H. Austin Survey, Southwest Flank, flowed 232 barrels from Lower Frio No. 2 sand, Oligocene 9382-444 feet, and Lower Frio No. 4 sand 9693-718 feet, 33-gravity, 10/64-inch, completed 5-10-52, TD 10,167.

Fayette County, Muldoon field. Hammon Oil & Refining Company's Frank Widel et al 3, John Vivien 1/3 League, flowed 67 barrels from Arnim "B" sand, Eocene 2290-93 feet, 30.1-gravity, 9/64-inch, completed 5-19-52, TD 2304.

Jefferson County, Big Hill, North field. Deep South Oil Company of Texas' Security Bank & Trust Co. 2, Block 18, Benson Subdivision, T&NO Survey, flowed 211 barrels from Marginulina sand, Eocene 8729-33 feet, 33.6-gravity, 1/8-inch, completed 5-15-52, TD 10,233.

Liberty County, Esperson Dome field. General Crude Oil Company's Esperson-Moore's Bluff A-66, GC&SFRR Survey, flowed 98 barrels from Vicksburg sand, Oligocene 5480-83 feet, 32.7-gravity, 1/8-inch, completed 5-1-52, TD 5858.

South Dayton field. The Texas Company's Wm. Duncan Welder et al 4, Wm. Duncan Survey, flowed 274 barrels from Vicksburg sand, Oligocene 8094-8140 feet, 36.7-gravity, 12/64-inch, completed 5-17-52, TD 8943.

Wharton County, Boling field. M. T. Halbouty's J. B. Gary Estate "A" 3-A, S. F. Austin Survey, flowed 156 barrels from Frio F-6 sand, Oligocene 6601-22 feet, 26.6-gravity, 9/64-inch, completed 5-13-52, TD 7334.

TEXAS DISTRICT 3—NEW DISTILLATE FIELD

Brazoria County, Flag Pond field, Superior Oil Company's Mae C. McDonald 1, Zeno Phillips Survey, Lot 4-A, McDon-

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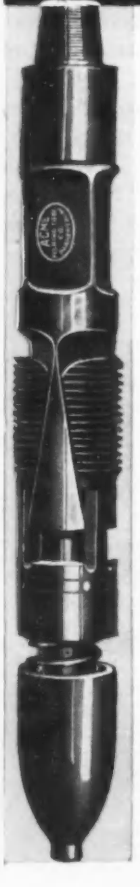

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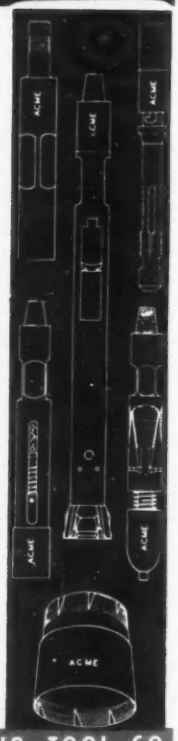

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ald Subdivision, flowed ungauged distillate and 81 million from Lower Frio sand, Oligocene 10,014-28 feet, 69.3-gravity, open and 45 barrels distillate and .2 million from Lower Frio sand 10,363-91 feet, 64.5-gravity, open, completed 4-29-52, TD 10,423.

TEXAS DISTRICT 3— NEW DISTILLATE PAY

Brazoria County, Chocolate Bayou field. Phillips Petroleum Company's Houston "R" 1-A, E. Andrews League, flowed 80 barrels distillate and 3.5 million from Andrau sand 12,847-55 feet, 45.7-gravity, 12/64-inch, completed 4-25-52, TD 13,658.

TEXAS DISTRICT 3— DISTILLATE FIELD EXTENSION

Colorado County, Garwood, North field. The Ohio Oil Company's L. A. Johnston 1, I&GN RR Survey, 1-mile southwest extension, flowed 219 barrel distillate and 8.5 million from Yegua sand, Eocene 5851-73 feet, 63-gravity, 28/64, completed 5-3-52, TD 6735.

TEXAS DISTRICT 3— NEW GAS PAY

Harris County, Durkee field. Union Producing Company's Bash Unit 2, George Green Survey, flowed 7.4 million from 7066-74 feet, open, completed 4-26-52, TD 7199.

Liberty County, Esperson Dome field. General Crude is Moore's Bluff 2-C, Angus McNeil Survey, southeast extension, not gauged from Yegua sand, Eocene 8972-74 feet, TD 10,073.

TEXAS DISTRICT 4— NEW OIL FIELDS

San Patricio County. Daubert & Achning's F. B. Frels 1, Block 8, Schliecher & Joseph Subdivision, M. P. & J. M. Delgado Grant, flowed 105 barrels from Lower Vicksburg sand, Oligocene 4708-12 feet, 1/8-inch, completed 4-28-52, TD 4848.

Unnamed field. Spartan Drilling Company et al's J. W. Bullard 1, Block 4, J. W. Bullard Subdivision, P. Fitzsimmons Survey, flowed 315 barrels from Lower Frio sand, Oligocene 8078-82 feet, 34.8-gravity, 10/64-inch, completed 5-17-52, TD 8137.

TEXAS DISTRICT 4— NEW OIL PAY

Starr County, Garcia field. Sun Oil Company's La Brisa Land & Cattle Company 1, Porcion 92, Tract 31, flowed 55 barrels from 4004-9 feet, 46.2-gravity, 9/64-inch, completed 5118-52, TD 6505.

TEXAS DISTRICT 4— NEW DISTILLATE FIELD

Hidalgo County. Hydrocarbon Production Co. Inc.'s Crain-Griffith 11, N. Capisallo District Subdivision, Farm Tract 2317, Block 48, flowed 49 barrels distillate and 4.2 million from Frio "B" sand, Oligocene 7151-57 feet, 55.8-gravity, open, and 15 barrels distillate and 2.2 million from Frio "C" sand 7272-90 feet, 56-gravity, open, completed 5-20-52, TD 8506.

TEXAS DISTRICT 4— GAS FIELD EXTENSION

Duval County, Peters Field. Tiger Minerals, Inc.'s W. R. Peters "C" 1-C, Section 37, GP&CNG Survey, ½-mile northwest extension, flowed 42 million from Yegua sand, Eocene 3235-49 feet, completed 5-12-52, TD 3579.

TEXAS DISTRICT 6— NEW OIL FIELD

Titus County, "Sugar Hill" field. A. O. Phillips & John B. Stephen's F. H. An-

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"Weco Fig. 602 Unions are perfect for manifolding, particularly in close quarters."

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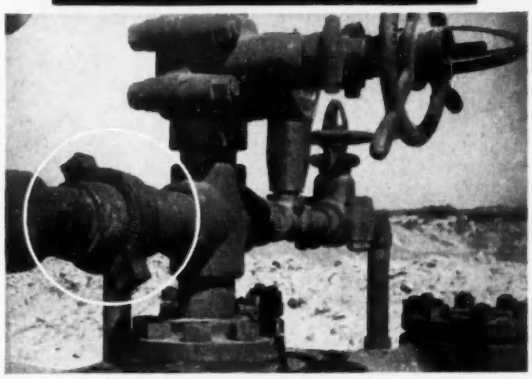


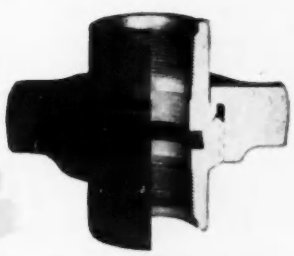
The Strong, Compact FIG. 602 is ideal for high pressures, rough service

The shorter, stronger sub ends of the WECO FIG. 602 UNION give it compactness plus the strength needed for today's deeper drilling. It is especially efficient for manifolding where clearances are limited and connections are close coupled.

The famous Weco steel-to-steel seat in the Fig. 602 is protected against abrasion and corrosion by a replaceable, resilient seal ring. It is available with sub ends threaded or bored for welding.

The Fig. 602 is another good example of why "It's Wise to Standardize with WECO." Start your standardization now, by specifying WECO Unions.

FIG. 602
6000 p.s.i. Test
Sizes: 1", 2", 3", 4"



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schultz 1, M. J. Davis Survey, pumped 204 barrels from Paluxy sand, Lower Cretaceous 4387-95 feet, 18-gravity, completed 5-23-52, TD 4407.

TEXAS DISTRICT 7-C— NEW OIL FIELDS

Reagan County. Cities Service Oil Company's J. F. Nunn 1, Section 3, Block B, L&SVRR Survey, flowed 359 barrels from Spraberry sand, Permian 6568-7362 feet, 38.8-gravity, 35/64-inch, completed 5-26-52, TD 7578.

Unnamed field. E. E. Fogelson & Edwin W. Pauley's O. F. Boyd 13-42, Section 42, Block B, L&SVRR Survey, flowed 229 barrels from Spraberry sand, Permian 7421-27 feet, 40.9-gravity, 3/8-inch, completed 5-14-52, TD 7457.

Unnamed field. White Eagle Oil Company et al's Ringo 2, Section 9, Block D, LS&V Survey, pumped 88 barrels from Spraberry sand, Permian 6478-6519 & 7339-46 feet, 39-gravity, completed 5-8-52, TD 7394.

Runnels County. Geochemical Surveys' John W. Harris 1-M, Block 514, J. V. Cabrera Survey, flowed 278 barrels from Upper Gardner sand, Pennsylvanian 3890-3904 feet, 44-gravity, ¼-inch, completed 5-12-52, TD 2989.

Unnamed field. John A. Messinger's M. C. Dale 1, J. C. McKean Survey 534, flowed 265 barrels from Strawn (Gardner) sand, Pennsylvanian 4172-82 feet, 46-gravity, ¼-inch, completed 5-17-52, TD 4220.

Schleicher County. Delta Gulf Drilling Company's B. M. Boyd 1, Section 9, Block H, GH&SA Survey, pumped 49 barrels from Canyon sand, Pennsylvanian 4413-38 feet, 34.6-gravity, completed 5-7-52, TD 5265.

Upton County. E. Constantin, Jr.'s D. M. Oldham Jr. et al 1, Section 12, Block B, CCSD&RGNG Survey, flowed 261 barrels from Spraberry sand, Permian 6900-7105 feet, 38-gravity, ½-inch, completed 5-5-52, TD 7829.

Unnamed field. Oscar Bourd Drilling Company & Clark Development Company's University Lands 2, old well worked over, Section 18, Block 15, University Lands Survey, flowed 250 barrels from Strawn sand, Pennsylvanian 8570-8612 feet, 40.6-gravity, 27/64-inch, completed 5-22-52, TD 8700.

TEXAS DISTRICT 7-C— NEW OIL PAY

Runnels County, Lloyd field. George W. Strake's A. L. Mitchell et al 1, Section 100, H. E. Baggs Survey, flowed 128 barrels from Gardner sand, Pennsylvanian 4756-68 feet, 44.9-gravity, 18/64-inch, completed 5-14-52, TD 4772.

TEXAS DISTRICT 7-C— OIL FIELD EXTENSION

Reagan County. Driver-Spraberry field. Indian Royalty Company's Powell Roberts 3, Section 36, Block 37, T-5-S, T&P Survey, 2 miles southwest extension, flowed 832 barrels from Spraberry sand, Permian 7541-7845 feet, 41-gravity, ½-inch, completed 5-15-52, TD 7892.

TEXAS DISTRICT 7-C— NEW GAS FIELD

McCullouch County. Charles H. Alexander, Jr.'s Siler 1, D. Rotherburg Survey, flowed 2.3 million from Ellenburger lime, Ordovician 1894-1960 & 2071-84 feet, open, completed 5-2-52, TD 2405.

TEXAS DISTRICT 8— NEW OIL FIELDS

Andrews County. Magnolia Petroleum Company's University of Texas Lease 36994-1, Section 17, Block 8, University Lands Survey, flow 556 barrels from Ellenburger lime, Ordovician 13,840-84 feet, 44.7-gravity, ½-inch, completed 5-20-52, TD 13,918.

Crane County. Jake L. Hamon's University A-1, Section 12, Block 30, University Lands Survey, pumped 97 barrels oil 145 barrels water from Cisco lime, Pennsylvanian 8357-65 feet, 42.1-gravity, completed 5-13-52, TD 9510.

Crane County. Magnolia Petroleum Company's Katie W. Lea 18, Section 22, Block 32, PSL Survey, pumped 52 barrels from Pennsylvanian sand 7425-7620 feet, 32.5-gravity, completed 4-27-52, TD 10,932.

Scurry County. Humble's James Davidson 1, Section 99, Block 3, H&TC Survey, flowed 315 barrels from Ellenburger lime, Ordovician 7590-7608 feet, 41-gravity, ¼-inch, completed 5-4-52, TD 7608.

TEXAS DISTRICT 8— NEW OIL PAY

Ector County. Goldsmith field. Gulf Oil Corporation's C. A. Goldsmith et al 712-H, Section 4, Black 44, T-1-S, T&P Survey, flowed 503 barrels from Holt lime, Permian 5106-20 feet, 40-gravity, ½-inch, completed 5-12-52, TD 5120.

TEXAS DISTRICT 8— OIL FIELD EXTENSIONS

Dawson County, Smith Spraberry field. Standard Oil Company of Texas' L. L. Huddleston 2-1, Section 1, Block H, ELRR Survey, ½-mile northwest extension, pumped 147 barrels from Spraberry sand, Permian 7934-72 feet, 37.5-gravity, completed 5-10-52, TD 7972.

Spraberry Deep field. Seaboard Oil Company of Delaware's Dean 1, Section 39, Block 34, T-5-N, T&P Survey, 1-mile west extension, flowed 161 barrels from Spraberry sand, Permian 6650-6893 feet, 40.1-gravity, 24/64-inch, completed 4-30-52, TD 6893.

Gaines County, North Riley field. Christensen & Mathews' M. S. Doss 1, Section 360, Block G, CCSD&RGNG Survey, ½-mile north extension, flowed 142 barrels from Clear Fork lime, Permian 6720-6935 feet, 32.8-gravity, ¼-inch, completed 5-17-52, TD 6935.

Glasscock County, Driver Spraberry field. Humble's Ivy Huegler 1, Section 33, Block 36, T-4-S, T&P Survey, 1½-miles east extension, flowed 203 barrels from Spraberry sand, Permian 7635-7700 feet, 40.1-gravity, 24/64-inch, completed 4-30-52, TD 7749.

Kent County, Cogdell field. Chapman & McFarlin's D. M. Cogdell "A" 7-B, Section 772, Block 97, H&TC Survey, 1-mile southwest extension, pumped 52 barrels from San Andres lime, Permian 1485-1510 feet, 37-gravity, completed 5-14-52, TD 1520.

WYOMING—NEW OIL FIELD

Sheridan County. J. Ray McDermott's Barry 1, NW NW SW 24-58n-85w, pumped 176 barrels oil and 44 barrels water from Shannon sand, Upper Cretaceous 4715-21 feet, TD 4798.

WYOMING—OIL FIELD EXTENSION

Fremont County, Pilot Butte field. Brinkerhoff Drilling Company's Gessell 1, NW SW SW 14-3n-1w, flowed 1900 barrels from Lower Muddy sand, Cretaceous 3872-3915 feet, 49-gravity, 3/4-inch, completed 4-20-52, TD 3915.

Weston County, Lodgepole field. Anschutz Drilling Company's Government 1, NE NE SE 17-45n-67w, ½-mile northwest extension, flowed 207 barrels from Newcastle sand, Cretaceous 7282-7305 feet, 41.5-gravity, ¼-inch, TD 7305.

WYOMING— NEW DISTILLATE FIELD

Washakie County. Gulf's Stockham-Federal 1, C SE SW NW 2-46n-94w, flowed 1940 barrels distillate and 20 million from Phosphoria lime, Permian 12,910-72 feet, 46-gravity, open, TD 13,324.

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Unitization Reduces Piping Needs

Permanent Pipe Anchored Within the Engine Substructure Eliminates Haphazard Methods, Speeds Rigging Practice

By W. B. COLVIN
WORLD OIL Staff

UNITIZATION of heavy-duty drilling equipment is recognized as a very important procedure; however, extension of the program to simple piping installations also will pay the operator dividends. Often, a rig is completely unitized except for the fuel and water lines which are strung in all directions around the location. To eliminate this condition and to speed rigging practice, E. E. Stevens, drilling tool foreman, Magnolia Petroleum Company, developed and installed the illustrated idea of permanent pipe anchored within the engine substructure.

Installation Inexpensive. Because fittings, regulators and piping employed are standard in the fuel water hookup, regardless of the layout pattern, this plan does not involve special equipment purchases. Aside from the purchase of a few inexpensive U bolts plus the time of a welder, the ultimate construction expense involved is just slightly more than laying the pipe on the ground. One rig move will easily pay for the few added dollars required in the original installation.

Simple Plan. Since engine substructures differ from rig to rig, actual layout of this plan must be designed to conform with the substructure design. However, even this chore is relatively simple since it merely involves spotting the fuel and water pipe where vertical extensions from the system will match the engine fuel and water inlets. Figure 1 shows how the main fuel log is placed and spot welded within the cradle of the substructure supports. Small diameter piping is

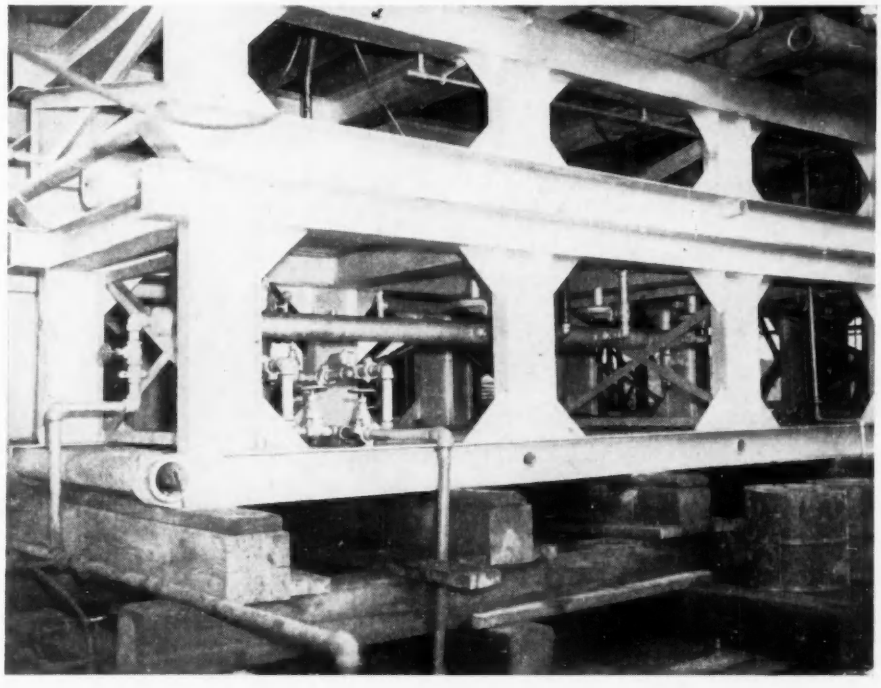


FIGURE 1. Overall view of piping pattern permanently installed within engine substructure. Access to control valves is convenient. Hammer-type unions expedite rig-up operations.

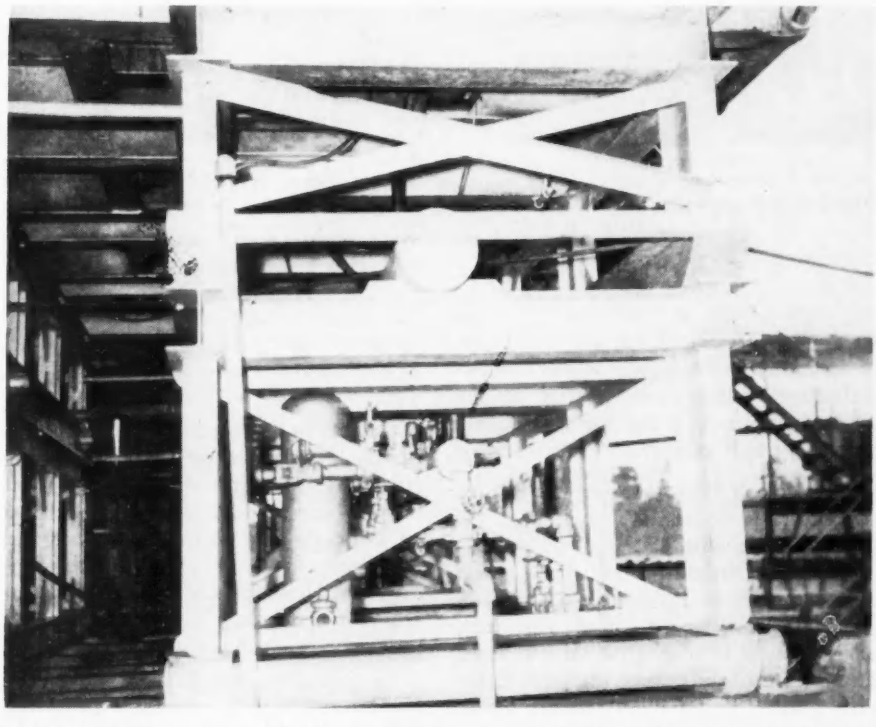


FIGURE 2. Big-inch pipe saddled in upper structure serves as fuel volume chamber. Vertical chamber attached to base of lower structure serves as fuel scrubber and scavenger chamber.

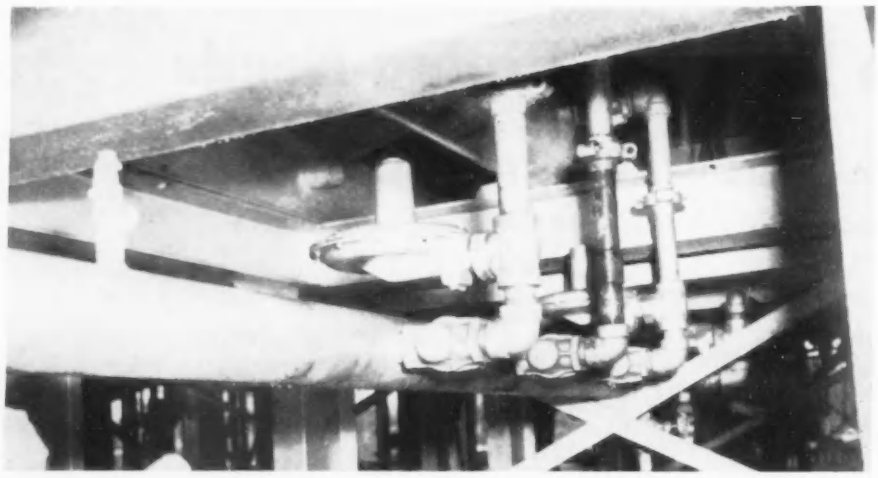


FIGURE 3. Pressure-regulated fuel is routed from main gathering log to large-volume drum above. Fuel manifold system is designed to permit quick bypassing or line blocking in an emergency.

FIGURE 4. Worrisome chore of filling radiators is erased with illustrated water hose system extending to a point above engines. By regulating conveniently located valves, the job of tending radiators is accomplished with comparative ease.

suspended from the substructure system with U bolts. Both are examples of the layout simplicity wherein substructure design is employed to an advantage in locating each segment of the system piping.

Gas Piping Plan. Master gas piping components include the lower log, the upper volume chamber and the scrubber tank. Dimension of these units will be governed by the rig engine fuel requirements. In each instance, as indicated in Figure 2, the master and volume chambers are sealed on either end with welded metal plate. The master log is then tapped to fit a two-inch line while side outlets feed fuel to each engine. Anchorage of the upper volume chamber is assured by welded and formed plate metal saddles.

Connection practice illustrated in Figure 3 is followed throughout the entire system. It will be noted that nipples are welded in the master log to connect the risers extending to the upper volume chamber. Unions are stationed in each pipe segment where uncoupling is required for repair work or rig transport.

In practice, gas regulated by the master rig system enters the manifold through a side connection shown in Figure 1. Entering the scrubber chamber through a two-inch bypass system, gas is then processed and released into the master log. From this point the fuel is again regulated (Figure 3) and distributed to the rig engines. Two-inch hose leads channel fuel from the volume chamber to each engine resting on the substructure. Use of hose segments reduces vibration transfer from the substructure system to the engines. To compensate for master gas regulator failure, a safety pop (Figure 3) is tapped into the master log. Each gas log is rigged with base drainage valves to bleed off fluids developed within the chambers.

Operation of the gas system has shown the following advantages:

- Rigup practice is speeded since preparation of the system for operation simply involves making up a few unions and connecting the unioned hose extensions to each engine.
- Regulator damage is reduced because each unit remains in a protected, out-of-the-way spot at all times.
- Efficient fuel scrubbing is possible with the permanently mounted system located for easy servicing.
- Transmission of vibration between the substructure and engine is reduced to a minimum.
- The system is safeguarded against flash pressure increases with pop valves.
- Installation charges are very nominal and will possibly pay out on the first rig move.

Water Piping Plan. The water supply system can be installed in record time since it includes the anchoring of just one master line. Figure 4 shows how the two-inch line is swaged down to match hose connections leading to the engine radiators. Unioned at either end, the hose sections can be removed for rig transport.

Aside from the radiator filling assignment, hose extensions are attached to the master line for utility purposes on the floor. Furthermore, the system can be connected to the drawworks brake to assure adequate cooling.

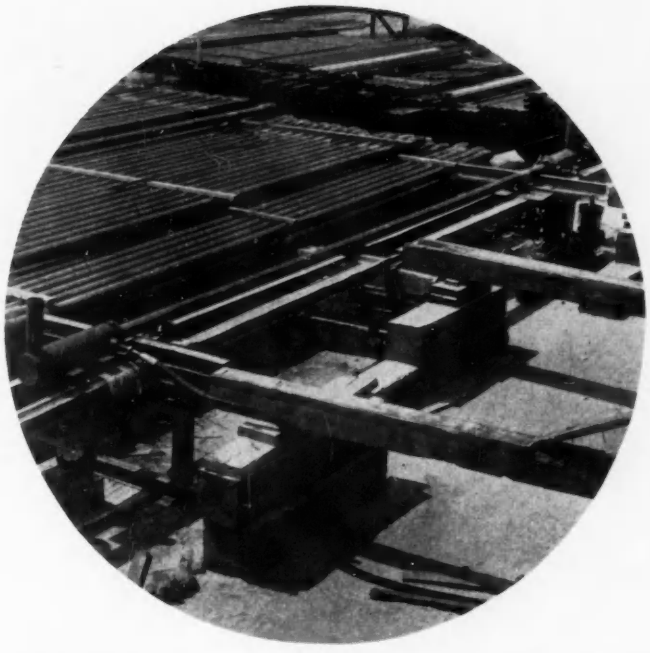
Advantages of the water system can be summed up by the fact that rigup practice is speeded because lines formerly strung on the ground are given a permanent station in the substructure system. Of course, the permanent system must be supplemented by lines for the shale shaker, mud system and other service requirements on location.

Shot Peening Cuts Drill Pipe Failures

Shop Tests Indicate Life of Equipment Is Extended by Four Times

By RALPH IRVING

General Manager, Vapor Honing Company, Houston



Here's a typical rig for sand blasting or shot peening tubular goods. The process here involves peening outside ends of drill pipe. Air-jetted shot is fed from chamber on extreme right through rubber hose and against rotating pipe. Used shot is trapped by casing segment surrounding pipe and dumped into bucket below.

A SHOT peened joint of drill pipe, compared to a similar joint which has not been shot peened, will withstand more than four times as many cycles of stress before it fails. This fact is quite important during times of tubular goods scarcity plus additional demands placed upon drill stems in operations below 13,000 feet.

The process of shot peening drill pipe includes blasting the inside surface with round steel shot until dangerous forming tensional stresses are relieved, the surface has been dented and worked so as to interrupt cracks and ridges which formerly provided sensitive failure paths, and the interior surface is placed in the favorable condition of compression.

Sand Blast Before Shot Peening

The objective in sand blasting is to remove mill scale. Sand and grit perform as abrasives to cut away mill scale faster and cleaner than do the round steel shot employed for peening. Blasting abrasives are often selected for their resistance to fragmentation so they can be re-used many times. However, the best abrasive to clean tubular goods is a sand selected because it is definitely fragmentary. Following the initial abrasive grain contact, the fragmented particles ricochet and hit the surface again to remove the mill scale from small cracks and pits.

The round steel peening shot, which are of the optimum size to flatten out, indent and interrupt the surface ridges, crevices and pits, will knock off much of the mill scale but they are too large to get down into and clean out the cracks and pits. Actually, they hammer the remaining scale into the base metal. This remaining scale will weather or spall-off and break the continuity of and squander the peening result. Even though sand produces some peening effect and shot does some cleaning, the desired end result is more rapidly and economically attained if:

- Mill scale is first removed with abrasive sand.
- The clean metal surface is peened with optimum sized round steel shot.

Recognized Industrial Tool

Shot peening is standard practice on many automobile and airplane parts. For years the front coil springs on a popular line of automobiles have been shot peened; they then take more than four times as many cycles of compression before average failure. Improved methods of peening, according to research reports, forecast an increase in that performance to the order of ten. Other familiar steel parts show the following life improvement after shot peening:

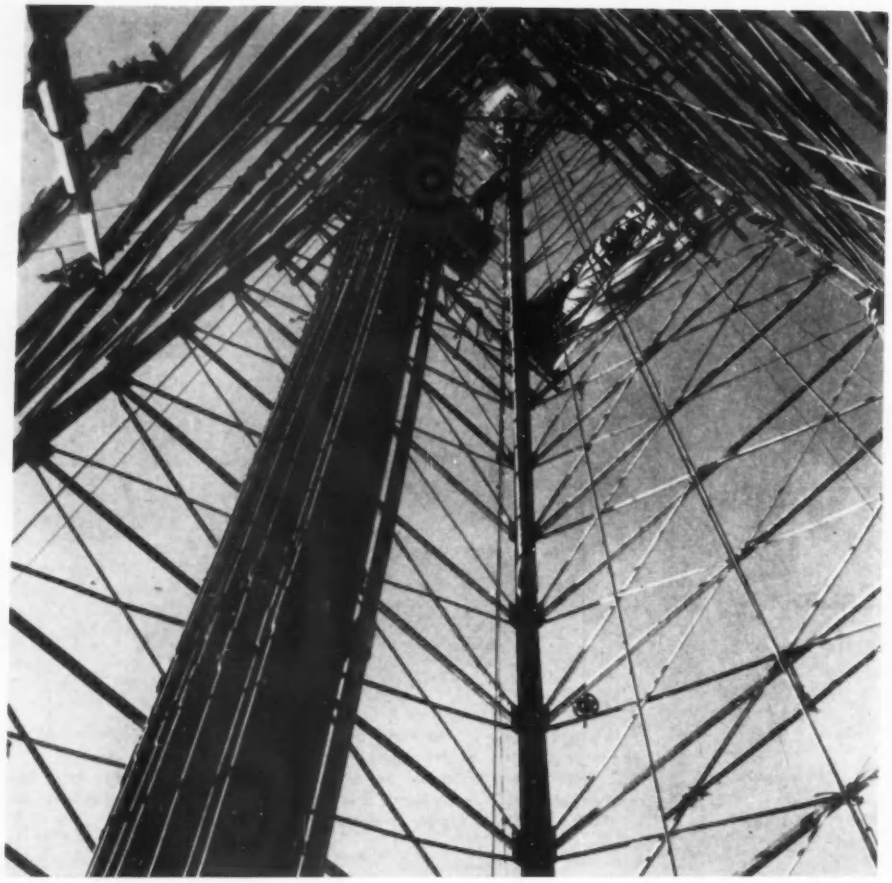
welded joints	310 percent
steering knuckle	475 percent
engine crankshafts	900 percent
gun extractors	650 percent
leaf springs	1300 percent

Desirable General Corrosion

The actual weight loss of steel in corrosive environments is still so small that if that loss is encouraged to take place as general, evenly distributed corrosion, drill pipe or tubing can last ten times as long before failure as it will if the corrosion is allowed to concentrate and produce failure in spots.

The first control operation is to sandblast the inside of the pipe to remove the mill scale. A mill scale free surface allows corrosion to:

- Affect the whole surface simultaneously, or



The present scarcity of tubular goods points up a need for regular maintenance programs. Test records reveal many advantages in increased pipe life through use of sandblasting and shot peening processes. Use of these processes removes mill scale and conditions the metal for longer use.

- To migrate over the surface as each anodic area becomes protected or passivated by oxide film to result in general or unlocalized attack.

When mill scale is permitted to weather-off out of control, on the contrary, it spalls off in chips, exposing freshly disturbed activated spots, scratches or crevices adjacent to large mill scale insulated or oxide film protected or passivated cathodic areas. Once anodic corrosive attack has started at the preferentially sensitive areas on this dissimilar surface it ceases to migrate; it takes up residence at these spots and concentrates and continues there in preference to others; it becomes autocatalytic to produce pits or other localized early failure channels.

When stress is applied the probability of failure is multiplied, since the mechanical stress may break chemically resistant bridges in the metal, and the chemical corrosive attack may break mechanically resistant bridges.

Only a limited number of these influences need line up to produce stress corrosion failure. Where small steel coupons do not show advanced corrosion while sections of a long heavy string of tubing do, for instance, it is suspected that stress is the critical factor.

A cleaned or a cleaned-and-peened surface obviously will reduce the physical and potential dissimilarities inhibitors must combat. Just as pipe line coatings reduce cathodic protection input requirements, properly prepared surfaces may similarly reduce inhibitor requirements and costs.

Corrosion fatigue failure, characteristic of drill pipe, is achieved by alternating stresses which produce disarrayed material which is corroded as it is formed. Although corrosion fatigue is complex and serious, the operation to control it is simple; it is shot peening.

Shot Peening—A Final Step

Shot peening, then, is a second corrosion control operation. Most of the standard practice shot peening, or its alternates, rolling as on threads, or honing as on tools, have been applied to machined surfaces which, obviously, were free of mill scale. However, it may be generally stated that:

- The first corrosion control operation, sandblasting, is a beneficial control of chemical corrosion.
- The second corrosion control operation, shot peening, is a beneficial control of mechanical corrosion.

But peening, without first removing the mill scale by sandblasting may stimulate bad localized spot corrosion if contaminated abrasives and hammered-in inclusions are factors as they are when the mill scale is sandblasted off to achieve more noble passivated stainless steels. Like painting over mill scale for the decorative purpose of hiding what is going on underneath, it may contribute to, rather than defer, corrosion failure of the steel.

Tests Prove Worth

Simulated drilling condition tests show that peened drill pipe compared to unpeened withstands more than four times as many cycles of stress before average failure. Because it is difficult to simulate the complex wet conditions of actual drilling on full-sized joints, these usually have been dry runs which show only improved resistance to pure or dry fatigue. They show only how much longer pipe can last in areas where failure is assumed to be due to mechanical fatigue because no pits or obvious chemical corrosion patterns occur.

To observe the compounded progress of mechanical fatigue in the presence of wet chemical corrosion, particular attention is being given to field service data on a carefully numbered string now drilling in West Texas. In this string one third of the joints have been left untouched as a control; one third have been sandblasted only; and one third have been sandblasted and shot peened.

Completion of this test, it is expected, will provide reliable field service data to confirm again that the first control operation, sandblasting to remove the mill scale, increases pipe service life more than 50 percent; and that the second operation, shot peening, places the peened surfaces in such favorable condition that they withstand more than four times as many cycles of stress before failure.

REFERENCE

[1] Removing Mill Scale Increases Pipe Service life, Ralph Irving, WORLD OIL—October, 1951, p. 140.

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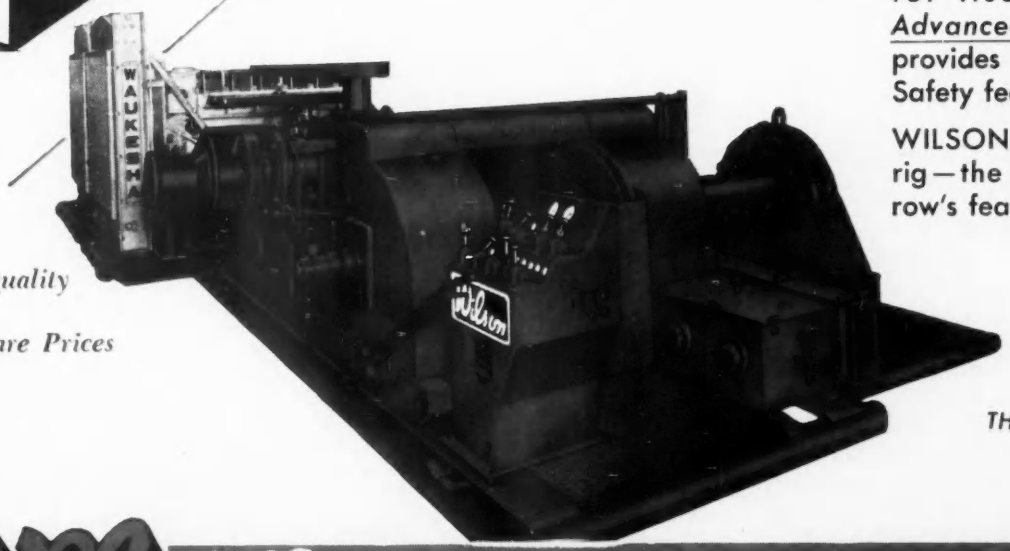

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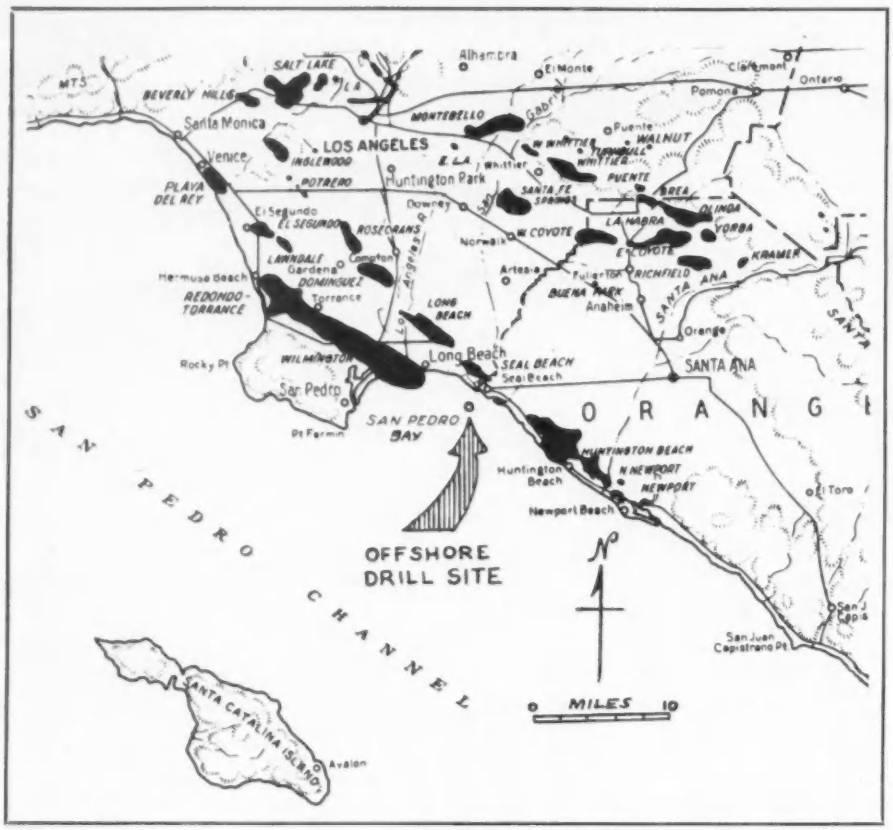


Map shows location of Monterey Oil Company's proposed offshore filled-land drill site off Southern California coast in San Pedro Bay area. Water at this point is 45 feet deep. Structure is expected to be completed in about four months. Oil fields are shown in black.

By GILBERT M. WILSON
WORLD OIL Staff

Offshore Land Structure Planned

Monterey Oil Company to Drill From Circular Steel Enclosure 1.5 Miles off Coast of California

A DEVELOPMENT unique in the exploration for oil in California will be started shortly with the letting of a contract by Monterey Oil Company to build a circular, filled-land structure 1½ miles off the coast. The site will be in 45 feet of water and adjacent to the proposed extension of the outer breakwater, between four and five miles southeast of the city of Long Beach.

The structure will consist of a circular steel enclosure 75 feet in diameter and built of interlocking steel piling. It will be filled with sand and clay and covered with a concrete deck. Surface of the structure will be 16½ feet above mean low water level, with derrick floor level designed to be approximately 25 feet above mean low water. A rock riprap, to be banked up at an angle around the base of the piling, below water level, will reduce scouring action of tidal currents.

A large, rectangular loading platform will be built on the northeast (landward) side of the structure. It will be equipped with docking facilities for the delivery of equipment and supplies needed for construction as well as drilling operations. The structure will be reinforced with a number of 78-foot reinforced wooden piles. Pilings will be used in both the circular structure and the loading platform. Cluster pilings will be placed at derrick leg points. It is estimated that about four months will be required to complete the structure. Initial cost of the exploration project probably will be in excess of $1 million.

Area Slant-Drill Tested From Shore

The land to be explored, a state tidelands lease, was tested during and immediately after World War II by a series of directionally drilled wells located ashore. These tests, although they were not conclusive, indicated the possibility of an offshore accumulation. However, because of mechanical problems brought about due to the distance from shore and the depth of the probable producing zones, the slant drilling development was not continued; it was thought that the structure could be better tested from an offshore drill site. Some idea of the mechanical problems encountered in these earlier slant-drilled operations may be gained from the fact that deviations from vertical, in some cases, reached as high as 83 degrees.

Plans call for a thorough and exhaustive test of the lease from this offshore drill site. Under present plans

• CONTINUED ON PAGE 116

CONFERENCE PANEL, left to right: John B. Fowler, drilling superintendent, Thomas P. Pike Drilling Company, Los Angeles; J. L. Mitchell, safety, California Production Service, Inc., Long Beach, Calif.; Harry Woodward, assistant drilling superintendent, Thompson-Carr, Inc., Lamesa, Texas; R. L. Houston, toolpusher, Great Western Drilling Company, Lubbock, Texas; M. L. Powers, Oklahoma A. & M. College, Stillwater, Okla; Ira French, division drilling superintendent, Rowan Drilling Company, Midland, Texas; M. L. Clayton, Sr., drilling foreman, Shell Oil Company, New Orleans; L. M. Rhea, toolpusher, Wheless Drilling Company, Junction City, La.; B. W. Smiley, drilling superintendent, Falcon Seaboard Drilling Company, Oklahoma City.

Making Rig Operations Safer

EDITOR'S NOTE: *A conference discussion on "Making Rig Operations Safer" commanded high interest at the Seventh Annual Drilling Industry Safety Clinic of the American Association of Oilwell Drilling Contractors in Dallas, May 19-20. The conference was led by M. L. Powers of Oklahoma A. and M. College as part of a program of which the chairman was H. H. Hillman, president of California Production Service, Inc., Long Beach, Calif. The entire conference was recorded by* WORLD OIL *and is offered here (in slightly condensed form) because of the importance of the topic and to demonstrate the conference technique.*

HILLMAN: The moderator for our program is very much at home in the oil family. He is a Centenary graduate, a registered professional engineer and has had a wealth of experience in oil field work, much of which has been done in conjuction with the API. He has been state supervisor of industrial education at Stillwater, Okla., and more recently the director of education for Shell Oil Company at Tulsa. He is currently director of the Engineering Extension Department at Oklahoma A. and M. He just completed a special assignment with Rowan Drilling Company which turned out very satisfactorily.

POWERS: This is somewhat of a dual assignment. We are going to try to accomplish two objectives at one time. The first objective is to demonstrate the conference method. The second is to discuss rig operations and safety.

The subject of rig operations has to do with attitude as much as anything else. I think that the safety engineers continually point to the three E's—Engineering, Education and Enforcement. The E concerning Education is the one that deals with attitude. Attitudes are rather elusive. They are hard to define. They are things we have to work at all the time.

A few years ago I was talking to a production manager who had been for some eight months conducting a course in conference leading technique for all his company's supervisors down to and including the head roustabout. Of course, I asked him how the thing was working out. He said it was working much better than he had anticipated. First, he said, they were getting better communications up and down the line. The head roustabouts were able to get information from, and precise information to, the man on the line. Communications, he said, had improved from all levels of supervision right on up to his office. He said he felt that he knew more about what was going on than ever before.

Then, as a kind of an afterthought,

he said that, incidentally, their accident experience had been greatly reduced during the past eight months. Understand, he added that information as sort of an afterthought.

That is what you can expect in using the conference technique. It is based on sound psychology because it operates on the premise that everybody wants a chance to be heard. Is there anybody here who doesn't want to be heard once in a while? We all do.

Understand now, I don't say that the conference technique is a cure for all ailments. It has its limitations. A conference is limited in effectiveness to those situations where you have no definite, specific single answer. If you do have, then your group thinking and group participation don't have too much value.

Another limitation is that it must be confined to those subjects and those topics wherein the group participating has experience and does have something to contribute. A conference has been referred to as a situation where we pool experiences. If there is no experience, and if we are not careful, we may be pooling ignorance. So we want to be careful to have people contributing who do have experience.

A third requirement is that the subject, in order to be most productive, be limited to some specific subject so that it will not get lost in generalities.

A fourth limitation, of course, is that the topic must be of interest in that we must have a specific problem or we may have it in the foreseeable future.

Now our subject is "Making Rig Operations Safer." There are several ways we can get into this problem. One of the approaches I think we might use would be first to consider for a few minutes those points, those situations, those cases of equipment, those operations which are hazardous and which do cause accidents. I believe that our panel here is qualified to name those situations and how to meet the hazards. Every man here has had many years of experience in working around rigs and all have seen plenty of accidents. They know about where most of the accidents occur.

We will start out by naming a few points or places where accidents occur. Now you will not see this blackboard, some of you in the rear, but all of you should bear in mind that a blackboard is very important in conducting a conference. This is not to say that it is indispensable, particularly in working with a small group. However, in working with a group of 8 to 10 or more, I think it helps to control attention and to direct the discussion. I am using it here for the benefit of those down at the front and also to give you a better pattern of how a conference should operate.

Mr. Smiley, will you start this thing off by pointing out one thing, situation, or piece of equipment around a rig which leads to accidents or where accidents are likely to occur?

SMILEY: The cathead.

RHEA: On the rig floor.

MITCHELL: Improper lifting—back injuries.

FRENCH: Mud pumps.

POWERS: All right, now we have four situations or points or acts wherein accidents frequently occur. Now, in order to try to prevent these accidents, in order to make our rig operations safer, I think it would be well to take a look at one of these. Let's start with the cathead. I'd like to consider here first some causes of accidents occurring at the cathead.

Mr. Houston, tell me one thing that might be considered a cause of accidents at the cathead.

HOUSTON: Fouled catlines, which somebody might get caught in.

POWERS: Any others?

WOODWARD: Grooved catheads and inexperience.

MITCHELL: Not paying proper attention to what you are doing at all times around the cathead.

POWERS: Yes, I think inattention deserves to be listed as one of the causes. Any others, Mr. French?

FRENCH: Worn rope or slack line.

SMILEY: Any sort of mechanical failure.

POWERS: Good. Now, gentlemen, since you obviously consider the cathead as a cause of frequent accidents, what we've got to do is to try to prevent the cathead accidents. So now we are interested in preventive action. What kind of preventive action can we take in order to reduce, if not eliminate, cathead accidents. Is there anything that we can do? What can we do, for instance, to prevent those lines from getting fouled?

MITCHELL: I have observed that fouled lines are often the result of the driller being careless and not taking all the slack out. If a man will pay proper attention to his line when he puts it onto a cathead and see that all the slack is out of it, and if he has had proper instructions in how to operate a cathead, I would say that accidents would be cut to a minimum.

POWERS: All right. Mr. Mitchell says that the driller's careless attitude in not taking the slack out of the line is one of the causes of accidents. Now, specifically, how are we going to get that driller to keep the slack out of the line and everything in order?

MITCHELL: I would say it would be a matter of supervision. The toolpusher should see that that man is properly trained and see that he complies with the rules.

POWERS: All right, now you have given us two suggestions. One is that the toolpusher should see that the driller is trained; and furthermore, that the toolpusher should see that the rules are enforced.

WOODWARD: Do you think that the toolpusher is going to be there 24 hours a day to enforce those rules?

POWERS: Mr. Mitchell, how would you answer that?

MITCHELL: I would say that, after a period of training, if the driller did not comply with the rules and regulations of the company he is working for, I would get somebody in his place.

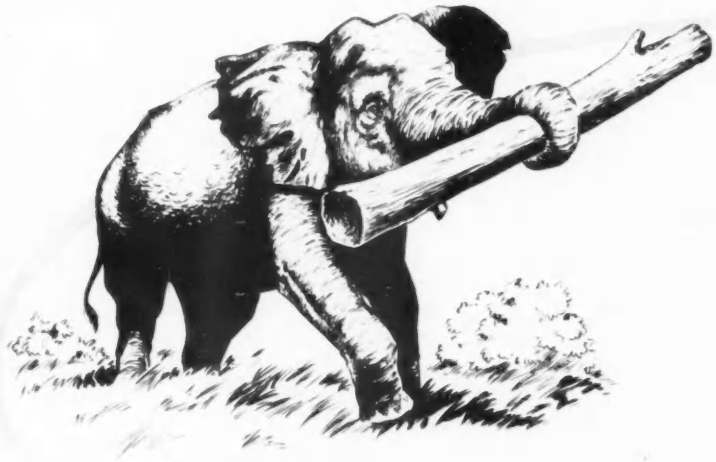
POWERS: All right, can we go ahead then and say that this fouled line is initially the responsibility of the toolpusher to train that driller and then to enforce compliance with the rules as the men are trained?

FOWLER: The driller certainly knows how a cathead should be handled and he ought to require anyone working on the cathead to handle it properly, not only for the sake of the man's own safety but because any weevils you have around will be watching the man handle that cathead and when they finally get hold of a cathead themselves, they will do it just as they have seen it done.

POWERS: Then we are agreed that the toolpusher should train the driller and should demand enforcement of the rules all the way down. The No. 2 item here is inexperience as one of the causes of accidents. What is the remedy?

CLAYTON: The driller should train the men to know their jobs.

POWERS: All right, now the next



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cause of accidents is grooved catheads.

FRENCH: The remedy for that would be to keep the catheads in good condition.

POWERS: And whose responsibility is that?

FRENCH: Toolpushers and drillers.

POWERS: Now what about inattention as a cause of accidents? How would you handle that?

CLAYTON: There should be absolute coordination between the man on the cathead and the driller.

POWERS: That means, then, that we've got to develop teamwork. How would you go about it?

SMILEY: Well, when a new man comes into an organization, he should be trained to teamwork.

POWERS: Right. This inattention thing is a good problem. I was talking to someone here this morning and I was told about a contractor who was doing both offshore and land drilling and I was told he does not have nearly as many accidents offshore as on land. The reason he gave is that the constant exposure to accidents and the constant realization that the accidents can be very serious keep everybody more attentive. Therefore, they do not have as many in offshore drilling. I hadn't thought of it before, but apparently there must be something to keep the men aware of the fact that an accident can happen at any moment. Anybody else have any ideas on teamwork?

MITCHELL: In training a man for a job on a cathead or anywhere else, you not only have to train him for his job, but you have to give him an example of what you are trying to tell him. Give him a good example and sell him on the idea that you are thinking of him from the standpoint of him being a human being and a valuable part of the organization, and you'll get your teamwork. If you don't do this, a man is prone to accidents because he really doesn't know what to do.

POWERS: All right, then, one of the best ways to prevent accidents is to sell men by example. Now we come to worn rope or spliced line as a cause of cathead accidents.

FRENCH: Rope should be kept in good condition. That is something like the grooved cathead. It's a matter of inspection and replacement.

POWERS: The next one here has to do with other mechanical failures. How can we eliminate cathead accidents coming about through other mechanical failures?

CLAYTON: There are guards that will help prevent such accidents.

POWERS: Now, gentlemen, let's take a look at what we've done here. We have listed four situations that cause accidents and we have spent about 40 minutes expanding the first one. That's the cathead. The things which cause accidents on the cathead we have listed as the fouled line; inexperience; mechanical defects such as the grooved cathead; inattention; worn rope or spliced lines and other mechanical failures.

Now in order to prevent that kind of accident the conclusion here is that the toolpusher must assume the responsibility of teaching the driller to function efficiently, which includes the driller passing on training to his men on their respective jobs.

We have agreed that there shall be supervision and enforcement of recognized procedures. Also that no one is to handle a cathead who is inexperienced or without proper training. Before a man is allowed to take full responsibility for that job, he should be trained to do it.

Equipment must be inspected and kept in good condition. That will prevent mechanical failures. Proper guards must also be installed and kept in good condition. We must try to develop teamwork. Try to train men by setting them a proper example.

Those are the conclusions we have reached. Now I want to ask you this question. If this conference had been moved out to one of the rigs and participated in by one of your superintendents or toolpushers or drillers—and if the men had been led to think through these problems we have discussed, what effect would it have on those men in trying to reduce this particular type of accident?

FOWLER: It would have a real effect.

POWERS: Whose ideas, by the way, would these ideas on the blackboard be if we had held this conference on a rig?

FOWLER: The roughnecks'.

POWERS: Would a roughneck admit he has good ideas? Probably not. But he does. And he would be more apt to carry out his own ideas developed in this way than he would if you went out there and tried to tell him what to do.

Gentlemen, I hope that you have received some ideas that you can use in improving your own safety meetings through use of the conference method.

Offshore Land Structure

■ CONTINUED FROM PAGE 112

the company intends to drill the first well vertically, then to follow up with at least two slant-drilled tests. The first well probably will be taken to basement, which is estimated at 6500 to 7000 feet. Should the first three wells be commercially productive, three more probably could be drilled from the same site. An addition probably would have to be made to the initial structure, however, if any additional wells were to be drilled.

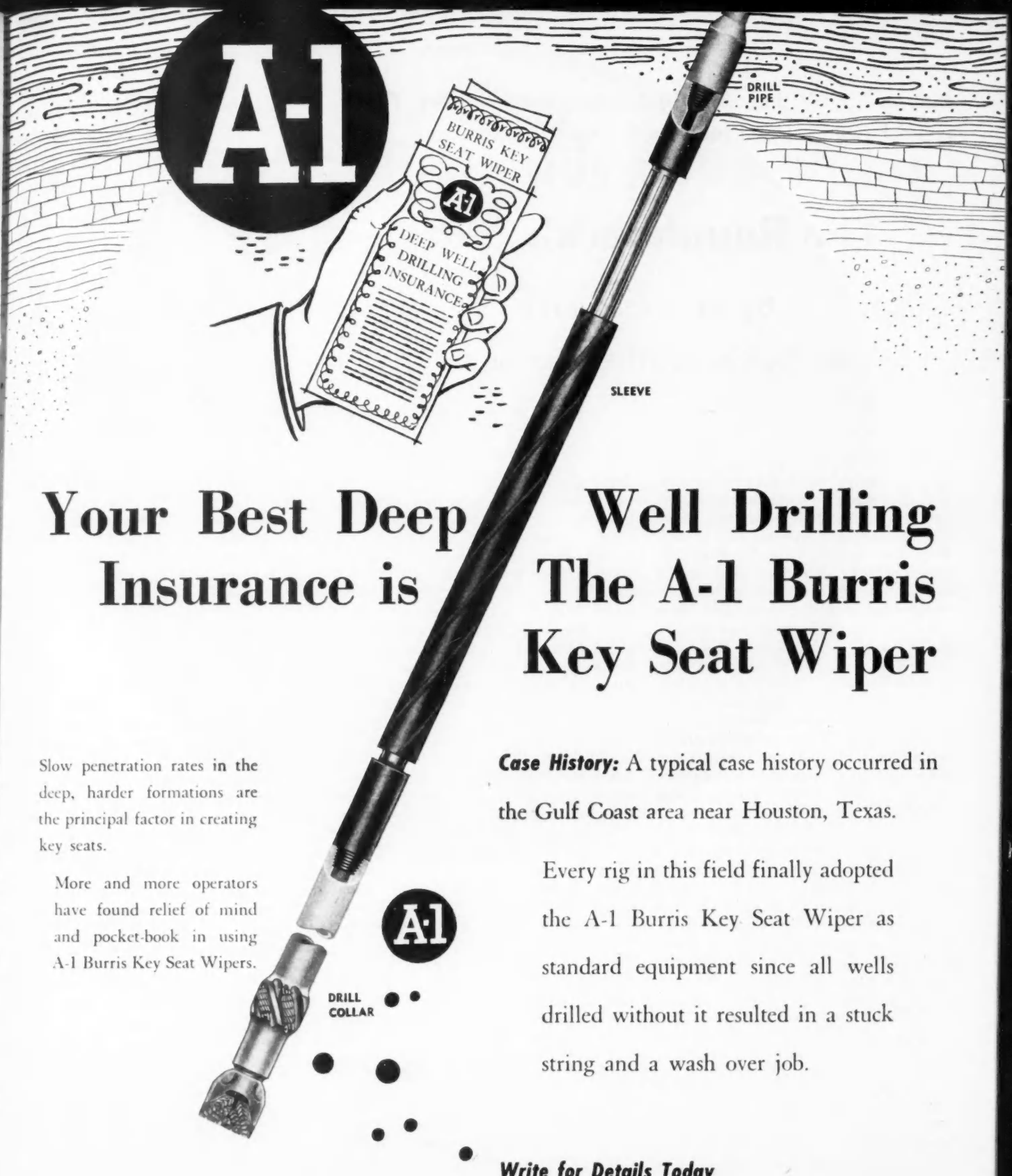
The filled-land structure is designed to accommodate a 136-foot standard derrick. It is expected that drilling equipment, blowout preventers and general operations will be conventional. If commercial production is found, it is planned to produce the wells directly into barges. Later, if production or other conditions warrant, a submarine pipe line would be considered.

Drilling Permit Issued

Approval for the project has been obtained from the Department of the Army (Corps of Engineers), which exercises control over navigation on inland and coastal waters. In addition, objection has been withdrawn by the Justice Department and Department of the Interior. These departments are involved under terms of the stipulations between federal and state governments under which all California tidelands and submerged lands operations presently are being carried out. Permit to drill has been obtained from the California State Lands Commission, which originally issued the lease.

Testing of the offshore lease is considered of prime importance to the West Coast, particularly in view of the present short supply of oil in California and in view of the national defense effort and military requirements in Korea, a large proportion of which is supplied by California. Monterey Oil Company is the successor to the Jergins Oil Company interests in the offshore lease. J. H. Abramson, vice president of Monterey Oil Company, in charge of the company's field operations, will direct operations of the offshore project.

Contract for construction of the filled-land structure, loading platform and docking facilities, has been awarded to Healy Tibbitts Construction Company of San Francisco, which has constructed more than half the wharves and docks in the San Francisco Bay area.



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Maybe I'm Wrong, Mr. Contractor, but I Believe You'll Have Fewer Labor Problems if You'll Listen to

The Roughneck's Side

By AN EX-ROUGHNECK,

As Told to AL REESE, WORLD OIL Staff

BEFORE they put me to running a rig I liked to work derrick. Especially at night. You stand up there with your feet out of the mud and nobody to tell you to throw your old hunting cap away and get your thick skull under a hard hat, and you look up past the crown block at the stars and then maybe down at the town and the refinery way off over there and you wonder how they get people to work in those places.

I used to wonder how they could stand breathing second-hand air and not being able to turn around without asking somebody to move over a little, please, and not being able to eat when they got hungry and got the time, and having 49 bosses yelling at them and some big shot union guy ordering them to go on home on strike and don't pay any mind to who's going to feed their families.

I reckon some people will say this shows I'm pretty dumb. Maybe so, but it also shows I liked my work and that I'm not mad at anybody, and that goes double for all the contractors I worked for. I put in 15 years for them, roughnecking and running rigs, and I'd have put in another 15 and more if a lung abscess hadn't come along and run me out of the oil fields for good and all.

They did all right by me and I'd like to do them a good turn by telling them about the roughneck's side of this labor problem I've been reading about. It could be that my ideas are all wrong, but Mister, if I'm wrong, then there are a lot of people working for you who are wrong, too, because they think like I do. So if I'm wrong, you'll be doing yourself a favor if you'll get out there and explain things to those guys. Do that one simple little thing, Mister, and then step out of the way and watch them dig a hole like she's never been dug before.

I guess the big gripe about every job has got something to do with money. With us, it's traveling expenses. We'll work on a well 30 or 40 days, maybe less, and then the rig comes down and we shell out $100 to move. Sometimes it's more, and sometimes less, but it'll average about that, although most drillers and roughnecks don't own a stick of furniture heavier than a table model radio. Deduct $100 out of a roughneck's pay every month or so and see what that leaves him.

And then take day-to-day travel from home to rig and back. You know how we work it. The guys on the rig have a car pool and each man drives his car for a couple of days straight and then rides with somebody else while the garage man is plugging a hole in the radiator which got socked by one end of a plank on one of those board roads. A car will last us maybe 15 months, even when you're closer to your rig than I was the time I was living in Hobbs and my rig was near Odessa, a flat 90 miles from my front door.

No Car, No Job

And what happens if we let a car wear out or have a wreck or something and can't afford to have it fixed? If you don't know the answer, I'll tell you how you can find out. Take the best roughneck you've got and the greenest weevil you can find and take the roughneck's car away from him and give it to the weevil. Then send them to a driller who needs a man. Do that and see which one the driller hires. Nine out of ten will hire the weevil.

Sure, the driller wants to do you the best job he can and he wants the most experienced hands he can get, but if there's a man on the rig without a car that means the driller has got to drive his own car that much more.

So who suffers the most when we can't afford to keep our cars in shape? We lose a little money, sure, but that weevil can lose YOU a hole.

I'm wishing that you could do something like during the war when you allowed us 7 cents a mile traveling expenses or 50 cents a day for each man in the car pool. Or, if it's true what I heard somewhere about the insurance companies making you cut out the car allowance because we were on the pay roll on the road and right up to our front doors—if that's true, then how about a cost-of-living bonus? And maybe a week's vacation with pay for the fellows who have worked for you a year or longer. Maybe you can't afford to do that. I wouldn't know. All I know is the roughneck's side.

A lot of roughnecks and drillers are always trying to get far enough ahead to buy themselves a trailer. With a trailer you could move cheaper, your wife wouldn't have to chase all over a strange town trying to find a decent apartment for less than $85 a month, and you could maybe park the trailer pretty close to your kid's school. Roughnecks' kids have it tough. My daughter, Joyce Ann, who is ten years old, went to five schools in five months the last school year.

You know your business better than I do, so maybe I'm wrong in thinking it would save you money in the long run if you could see your way clear to help finance a trailer for the drillers who have been with you three or four or five years. If you could do that you could have your pick of the best drillers there are. And the best roughnecks, too, because they'd have

• CONTINUED ON PAGE 126

Mud Control Demands Cooperation

Engineers and Field Personnel Must Work Together to Carry Out a Successful Program

By A. S. WUKMAN

President, Coastal Engineering & Chemical Service

Houston

THE merits of a mud control program can be greatly aided by the coordination of technical knowledge, possessed by the mud engineer, and the practical knowledge of field personnel who are actually performing the work on the drilling fluid during the history of the operation. The value of the mud engineer's work will be greatest if the application of his abilities contributes to the successful solution of problems which may necessitate a considerable change in the outlined mud control program due to unpredictable changes.

Programs in Mud Control

The mud programs to be given field supervisory personnel may generally be found to lack necessary flexibility. This flexibility should be provided in the mud program so that field personnel can be made more useful in accomplishing a successful mud program. In the process of drilling a well the occurrence of the unpredictable incidents may occur when the mud engineer, and possibly the toolpusher, are absent. This will leave the solution of the problem to the driller. Therefore, the mud engineer should always discuss the entire mud control program with all personnel on the well. In many cases, mud control is presented too vaguely to field personnel and, due to their lack of proper understanding, they will be prone to avoid assuming any responsibility in making constructive changes in the procedure. It is quite probable that changes the field men arrange would be very helpful in guaranteeing a successful program. The mud engineer should endeavor to have the field men informed so that they will voluntarily make necessary changes in the control procedure.

There are times when the mud engineer may desire to make a change in the outlined program; however, it may be difficult to secure the operator's approval. The recommended change may be disapproved due to the added cost, or because the operator may consider that the information on the drilling report does not justify an alteration in the procedure. A case of this type could be when the mud engineer is informed by the field personnel that there is a considerable loss of drilling fluid during the initial circulating cycle following a trip. Following a thorough study of the information offered by the field men, the mud engineer may desire to make a change in the rate of mud mixing for raising the fluid weight or he may request the immediate addition of lost circulation preventative additives to the drilling fluid. In most cases, the report of a loss of drilling fluid after a trip is considered as a routine occurrence until the extent of the loss has developed to a sizable amount. In order to get the operator's approval, the mud engineer should make a personal check with the toolpusher and then prepare a special report to the operator with their combined recommendations for changes required in the previously outlined mud control program. Based on the contents of such a report, the operator will usually give the problem more thorough consideration and, in most cases, the recommended changes will be authorized.

Hints by Field Men

There are times when the field men provide valuable information in regard to the drilling mud; however, the engineer may be prone to disregard the information as being useless. It will pay dividends to the mud engineer to make a thorough study of all information which is relayed to him by the men working on the job and he should be very cautious in discarding information as being useless in the mud control procedure. It is best for the engineer to discuss the information which he does not intend to use with the individual who presented the recommendation and explain the reason it cannot be employed. The field men can inform the mud engineer of the occurrence of certain incidents which may require an alteration in the proposed mud control procedure in order to prevent the development of an undesirable mud problem on the well. For example, the derrick man may notice that while a certain formation was being drilled, there occurred a considerable loss of drilling fluid. In the majority of cases, it will be found that the derrick man will not mention the incident as he may consider the information not desirable to the mud engineer and the condition could gradually develop into a serious problem. While the engineer is working on the lost circulation problem, he will probably learn the original cause. However, had this information been relayed to the engineer at the time it occurred, he could have possibly prevented the further loss or at least minimized the loss of the drilling fluid by making a change in the mud control procedures. The sooner a corrective action can be started on a mud problem, the greater the possibility of obtaining a useable solution. The mud engineer should endeavor to impress this line of thought upon field personnel so they will understand the necessity of relaying such information to supervisory personnel.

Mud engineers should acquaint themselves with the various operations which are performed by the drilling crews during the 24-hour period of operation. This will prove helpful in the mud engineer's planning of work which he desires to be carried out on the drilling fluid during the operation. The proper planning of the mud control work will prevent the occurrence

of any incident which may hamper the performance of the necessary work required to maintain a satisfactory drilling fluid. The engineer should realize that the responsibility of the toolpusher covers all operations performed on a well and that the time of the rig personnel has to be budgeted so the drilling operations will progress at a satisfactory rate. It is best for the mud engineer to discuss with the toolpusher the nature and extent of all operations he intends to perform and request suggestions. There are times when the mud engineer may fail to advise the toolpusher that he would desire a certain amount of time to complete a proposed treatment and, as a result, the treatment may be curtailed due to a change in the nature of operations being performed by the crew. This may involve a change from routine drilling to making a trip and, as a result, it is impossible for the engineer to complete the proposed treatment.

The conversion of a mud system should always be planned with a proper understanding between the mud engineer and field personnel. In this type operation, the mud engineer should give the toolpusher adequate time for the proper preparation of the rig as there may be some equipment requiring attention to insure satisfactory operating conditions. It is essential that the mud engineer thoroughly discuss the procedure he intends to follow with all field men involved in a mud-conditioning procedure. By presenting preliminary discussion of the procedure, it will be found that most of the operations will be performed with a greater degree of efficiency and the necessity for on-the-job instruction will be eliminated. In planning various procedure, the mud engineer should attempt to consider all suggestions from the field operating personnel. Use of such information can be helpful in simplifying operating procedure and, in this manner, the occurrence of serious mistakes will be greatly minimized.

Knowledge of Equipment Layout

The mud engineer should make a general study of the entire mechanical layout on a drilling rig. Having a good working knowledge of all the equipment and with a thorough understanding of the units directly used in the mud system, the engineer will be better qualified to handle assignments. Since the equipment layout will vary from rig to rig, the toolpusher can be very helpful in his explanation of the general purpose of the setup and the limitations which exist in the use of the equipment. It is important for both the engineer and the toolpusher to be certain that the essential equipment used in the mud system is always in a good working condition so the need for their repair will not arise at a time when they are performing the mud conditioning operation.

In the drilling of a well, an unknown formation may be drilled which will require a sudden change in the existing mud weight so as to prevent the influx of salt water or gas into the mud system. The mud-mixing facilities may be adequate if all of the available mixing hoppers are in a satisfactory working condition, but generally, when the emergency need arises, some of the units may require a considerable amount of repair. If there is more than one hopper, the field men will usually resort to the use of one specific mixing hopper for the daily blending of mud materials. The extra hoppers are left unused until an emergency condition arises where it is essential to use all units. In order to keep all mixing hoppers in a good condition, it is advisable for the supervisory personnel to require the crew to rotate the use of the units. By such rotation, the field man can detect and make necessary repairs.

The toolpusher can be helpful to the mud engineer if he will advise changes which are made in the general equipment layout, especially the changes which may have a considerable effect upon the mud system. These alterations may include the removal of a mud pump from the system or the changing of liner sizes. Due to the lack of knowledge of a pump liner change, the mud engineer may use the wrong liner size in computing the time required for the mud to make a complete cycle. Use of the wrong cycle will cause the cyclic treatment of the mud to be in error and may develop undesirable results in the mud treating program. The engineer can prevent such errors by making it a practice to check the liner sizes of the mud pumps prior to the beginning of the cyclic treatment.

If the desired mixing rate is based on a certain rate of mud circulation and the rate is decreased by a change in pump liners, there is a possibility that loss of circulation may occur due to the increased mud weight resulting from a different mixing rate contributed by the reduced circulating volume. The change in rate of circulation can also cause the occurrence of an unbalanced mud column which will hamper operations performed by the drilling crews due to back-flow when a connection is made. By an explanation of some of these problems which may develop, the mud engineer will have the advantage of increased cooperation from the drilling crews.

Maintenance of Mechanical Phase

Performance of any constructive work will seldom be considered in an unfavorable aspect by the operating personnel; however, the completion of mud control treatment offering little advantage will not be welcomed with any particular approval. If the mud engineer will discuss the value of mud conditioning operations with field men, it will increase the individual's interest and the control work will be more satisfactory.

The removal of sand and well cuttings from the mud pits will meet with a considerable amount of opposition; however, if the undesirable effect of the sand and well cuttings is discussed with the field men, they will expend greater effort in trying to prevent the presence of such materials in the mud system. The field men would rather remove the sand from the steel mud pits than have the responsibility of replacing line fittings and valves which are cut out by the high sand content of the drilling fluid.

The relative value of the prompt removal of well cuttings and old wall cake may be underestimated by both the mud engineer and the toolpusher. It is a usual occurrence to find the

About the Author

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shale shaker being partially or wholly eliminated from the system, thereby allowing the cuttings and wall cake to enter the mud pits. Bypassing the shale shaker is generally done when the properties of the drilling fluid are of such a nature that it will not fall through the shale shaker screen. When the drilling fluid is in this condition, it will be found that there is a considerable amount of foreign material in the fluid and the use of the shaker is most desirable. Every effort should be made to circulate as much drilling fluid as possible over the shale shaker, even though it may necessitate a reduction in the circulating rate. This is especially true when the mud is being circulated the initial cycle after a trip as the mud will be carrying a considerable amount of old wall cake and cuttings which have been dislodged by the drill pipe while on trip.

The continual practice of bypassing the shale shaker will allow the accumulation of a considerable amount of well cuttings, sand, etc., in the mud pits. The engineer should inform the personnel of the problems which may result from such practices. There are times when the reserve fluid volume in the mud pits may be found to be insufficient because accumulation of materials has appreciably decreased the effective capacity of the mud pits. This condition will usually be learned when lost circulation develops and the necessity arises for reserve drilling fluid. The occurrence of such a problem can be eliminated if the engineer and toolpusher will check the condition of the mud pits and inform the operating personnel of the danger if the volume of the pits is allowed to decrease by the accumulation of foreign materials.

Additives, Control Procedures, and Mud Conditioning

The field man's knowledge of various mud additives is generally confined to the more common types such as clay, bentonite, quebracho, etc. The field men gain considerable knowledge of the various additives by the actual use of materials in the mud conditioning operation. They may lack knowledge of several mud additives, especially some of the new materials which are continually being developed by research organizations. The mud engineer should endeavor to instruct the field personnel so they will have a good working knowledge on all mud additives which may be used in mud conditioning. By giving such instruction to the field men, the mud engineer can develop a considerable amount of interest in the mud control work to be performed in the conditioning of a drilling fluid.

In some cases, it may be possible for the field men to perform the necessary mud conditioning work when the engineer is not readily available for recommendations, and the performance of such work may prevent the development of an undesirable condition. For example, the mud engineer may leave the field men with instructions to mix a specific amount of materials; however, due to an error in the engineer's computations, the recommended amount of materials may be excessive. The characteristics of the fluid may become unsatisfactory and further conditioning will be essential to compensate for the overtreatment. To prevent such an incident, the field men should be trained to make routine checks on the drilling fluid as they are blending additives.

In order to impress the field personnel with the importance of the time factor in mud conditioning, the engineer should explain the changes which may occur if certain mud materials are added to the drilling fluid. For example, the full effect of bentonite cannot be determined when the material is initially blended since time is required for the bentonite to hydrate before the maximum effects will be noticed.

The field men should not be restricted on the use of the various additives to the drilling mud as there will be times when they can add the required materials and thereby avoid the development of a more complex problem. It may be a case of the settling of weighting material caused by an unavoidable dilution of the solids in the drilling fluid. If the field men are advised of the advantages of various additives, they can mix such an additive and prevent the further loss of the weighting material.

It is advisable for the mud engineer to discuss the use of chemicals with field personnel and to provide them with a general guide indicating which chemicals are to be used to correct certain conditions. The field men should be given freedom in the use of essential chemicals and they should not be limited to the use of a specific quantity of chemicals for conditioning mud. The strict limitation of the quantity of chemicals may lead to the development of an undesirable condition in the drilling fluid.

The mud control program should prescribe the use of a certain quantity of chemicals each tour. If an increased amount of contamination occurs, provisions should be made for the use of additional chemicals so as to properly condition the drilling fluid.

Field men may lack sufficient knowledge in regard to the necessity of carrying out a treating procedure in a certain sequence. Thus it is best for the mud engineer to explain why it may be necessary to follow a certain program. For example, in the preparation of a drilling fluid of a given mud weight, the materials which are first mixed include clay and bentonite. Barite is usually the final addition to the drilling fluid. If the men are instructed that it is essential to add the clay and bentonitic type of materials first so as to produce a drilling fluid which will have an adequate gel characteristic for the suspension of the barite, they will not carry out the mud mixing operations from a viewpoint that they have just a certain amount of materials to be mixed in the drilling mud. By their actual experience, the field men will find that the following of certain procedure will often decrease the amount of work required in mud conditioning. The field men will, in many cases, be able to provide the mud engineer with time-saving suggestions and the engineer should use the information in the conditioning procedure. In over-all mud conditioning, use of knowledge of various mud additives versus the knowledge of necessary mud control procedure will generally develop a satisfactory drilling fluid.

The mud engineer should give the field men some general information related to the various types of drilling fluids, and explain the purpose of using a specific type mud. The reason for changing a drilling fluid from one type to another will be questionable in the mind of the field men. It is difficult for them to understand why the mud engineer will change a good, easily maintained drilling fluid to a mud which may require considerable time in maintenance. However, if it is explained that the continued use of the old type fluid would be unsatisfactory if a formation was drilled which would cause contamination with salt, whereas the use of the new type drilling fluid would be relatively uneffected by a change in the salt concentration, the conversion work would be considered in a more favorable aspect.

A knowledge of the effects of solids in drilling fluids will assist in reminding the field men of the importance of the operation of certain equipment. For example, the use of the shale shaker to remove foreign material, such as old wall cake and well cuttings, will aid in minimizing solid concentration of the drilling fluid. The mud engineer should explain that the increase in solid conditions may increase the work required to condition the drilling fluid properly.

There may be times when a mud

problem may develop due to an error in the addition of the improper chemicals to the drilling fluid. Such errors may be made by the field personnel and they will be reluctant to relay the information to the mud engineer. The engineer should impress the field personnel with the fact that, in many cases, the required amount of improper chemicals to produce a very unsatisfactory condition may be rather small with reference to the quantity of chemicals being used for the mud control work. Also, that the proper corrective action can be performed best if the cause for the existing condition is known by the mud engineer. Therefore, the field men should not attempt to conceal such information from the mud engineer, as he will be able to correct the error much easier if he understands the cause of the existing condition.

Often, the field men and the engineer may be unaware of the cause of contamination by undesirable chemicals. This can occur where there is a use of chemicals in the treatment of the feed water in the boiler pits and these chemicals pass into the mud system with the fluid which is being used for mud conditioning. If this occurs, it is essential to correct such measures so that the water used in the drilling mud will not be mixed with the water treated for the boilers.

In Summary

In summary, the intent of this article is to give an over-all picture of the various problems which may develop in mud engineering work. Explanations have been limited to some of the more common type of problems and the author has offered suggestive plans which may assist in arriving at a solution. It is hoped that the various illustrations will show the necessity of having a good, cooperative program whereby the combined knowledge of the mud engineer and the field personnel can be used to an advantage in mud control work. Through such cooperative effort, the work of the mud engineer and the field representative will be considerably easier and misunderstandings will be virtually eliminated. In order to further develop a better understanding, it may require discussion and instruction by the mud technologist with field personnel on the various mud engineering problems. It is the desire of the author that the contents of this article may prove beneficial to mud technologists, field personnel and the operator. The combined efforts of all personnel is essential if a successful solution to a problem is to be accomplished in the most economical way.

The Roughneck's Side

■ CONTINUED FROM PAGE 120

something to look forward to when you put them to running a rig.

And speaking of having something to look forward to, I think it's bad business for you to go outside your organization and hire drillers and pushers. You ought to make your own. The way a lot of you operate, a roughneck can't ever expect to be anything else, so why should he strain a gut?

And I'll tell you another reason why you should make your own drillers and pushers. You go off somewhere and hire you a pusher and first thing he does is start yelling and cussing around to show the roughnecks who's boss. Hell, they know who's boss, and besides that they know something he doesn't know. They know that if he yells out just about one more time, he's going to have that rig all to himself. That's when you start losing money right quick.

We wonder why company toolpushers sometimes run a contractor's rig. Whatever the reasons, and I guess they're good, all right, any roughneck will tell you that a strange toolpusher can't do you as good a job because he doesn't know the rig and he doesn't know the men.

Another way toolpushers cause trouble is working the roughnecks. If the pusher is going to work the roughnecks, he ought to be made to hire 'em. And if he's not going to hire 'em, and most don't, then he ought to tell the driller when he wants a man to do something. I remember one time I was on evening tour with about two hours to go and fixing to come out of the hole. But when I looked around to tell the men, I found two of them gone. The pusher had sent them off to look for leaks in the water line, which was about five miles long.

So what happened? I was still sitting on bottom when the tour was up and the next crew had to make a round trip. They did it, but when they walked off the rig that night, they just kept on going. Next day I walked up to that pusher and told him to make up his mind. He could hire 'em and work 'em or he could tell me when he wanted something done. Well, he told me what he wanted done, all right, but jobs were plentiful and nobody got hurt but the contractor, who lost him a driller off one tour and the whole crew off another.

That reminds me of another idea that's so simple that it's bound to be all wrong or somebody would have done it before now. The pusher and I, we've got equal privileges about me working for him. If he doesn't like me, he can run me off. If I don't like him, I can go home. But a lot of times it's all personal, just between us two; so instead of me leaving the company when I go home or get run off, why can't I just get me another job for the same company? Looks like I could appeal to the contractor or somebody and he could check back with the pusher, and if the pusher said "Yes, it was just personal and I plain don't like the guy but his work is okay," why then it looks to me like the contractor could put me to work for somebody else.

About Safety

Maybe some of you wonder what we think about your safety programs. Generally speaking, not much. It takes a long time to get used to standing there listening to a safety talk while all the time you are looking at a patched-up walk that's liable to kill somebody, and just because the toolpusher is too tight to buy one little board. Or maybe you stand there and look at the safety man and wonder why he doesn't talk less and look around a little. Maybe he'd find that the pusher ought to buy a swing for that mud line before somebody gets the stuffings blown out of him.

I don't mean the average pusher does like that, but you see an awful lot of them who think more about saving a few dollars than they do about keeping a good, clean rig. Besides, I think it costs them money in the long run. I remember when I was 17 and my brother-in-law put me to work on my first job. We had an old drawworks that somebody must have found in the slush pit and the rest of the outfit looked even worse. Well, my brother-in-law put us to work scraping and painting and I griped all day long. Everyone asked everybody but him if we were going to dig for oil or pasteurized milk, but nobody got any answer until one day a bunch of big shots showed up from the company we were drilling the well for. Not long after that, the contractor came by and told my brother-in-law that the big shots sure were pleased with how the rig looked. The contractor also said we wouldn't be moving far after we dug this well. And sure enough, we didn't. We moved over in the same field and dug a lot of wells for that same company. So the way I see it, my brother-in-law made money for the company and for the crew, too.

As I said right at first, Mr. Contractor, I'm sure not mad at anybody. And as I also said, maybe I'm all wrong. Nobody ever bothered to tell me anything but the roughneck's side.

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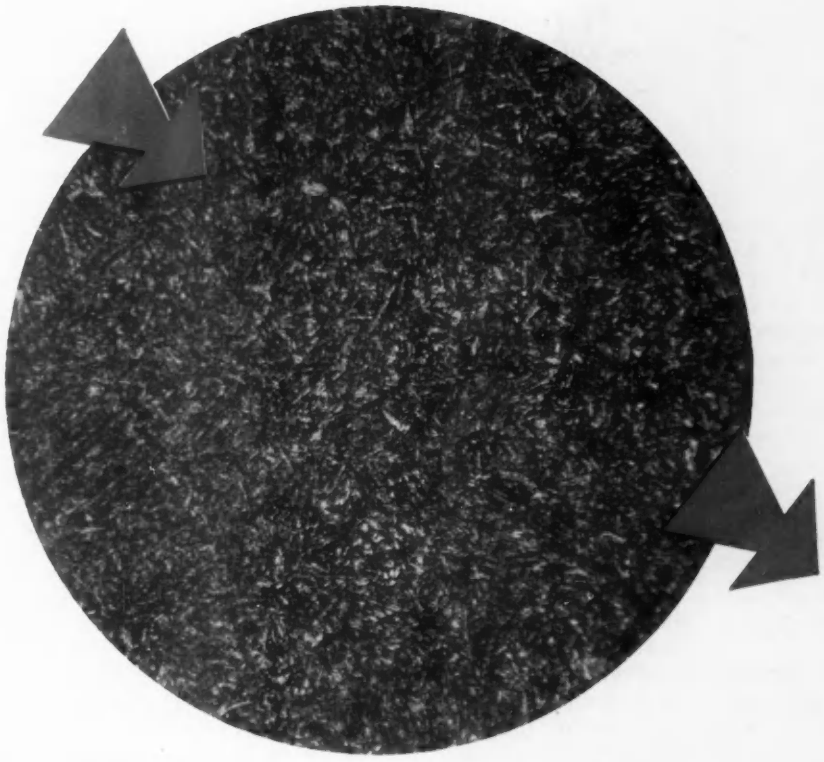

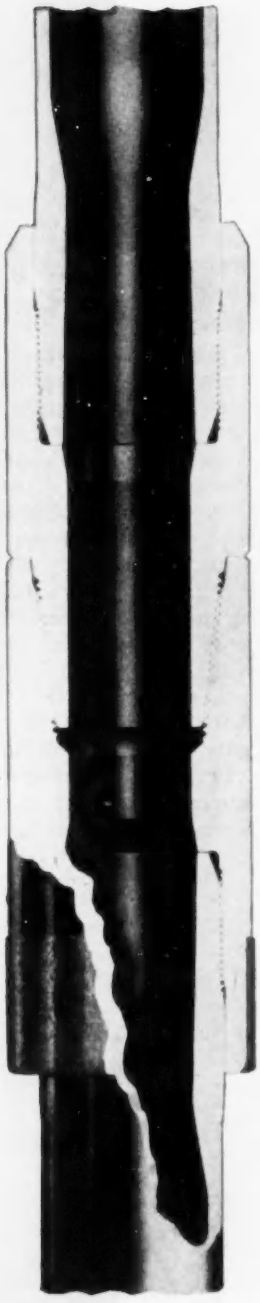

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Diamond Coring Increases in California

Since 1947, Use of Equipment Has Jumped 360 Percent; Each Head Averaged 222 Feet But Kept High Salvage Value

By H. M. STANIER
Sunray Oil Corporation, Los Angeles

Part 1

THE use of diamond coring equipment in California has increased to the point where it is an important phase of drilling operations. Coring has been, or is being done in almost every area in the state. In most cases, the percent of core recovery has been economical. The efficiency of diamond coring has been greatly increased due to improvements in equipment and technique.

Approximately 150,000 feet of coring has been done in the last four years. Fairly accurate records were available on about 75 percent of this footage. Very little information was available on rates of penetration or costs per foot of coring.

In hard formations, the economy, rate of penetration, core recovery and performance, generally have been very satisfactory. In softer shales and sands, the core recovery and performance have been good but the rate of penetration has been slower than conventional drilling.

The exact results to be obtained in any area or formation cannot be accurately forecast; however, the general performance to be expected can be anticipated. It remains for the operator to experiment with diamonds, and with various types of equipment, to determine if diamond coring is economical for his particular condition.

The use of diamonds is being developed for many other phases of drilling operations. Some of these are limited in their usage, while others, like diamond drilling bits, are unlimited in their possibilities.

At the Spring Meeting of the Pacific Coast District of the American Petroleum Institute, in Los Angeles, in May, 1948, William C. Harrington and Max C. Eastman presented a paper on "Recent Diamond Coring in California."[1] At that time 98 percent of the total footage cored had been in the Paloma, Coles Levee and Elk Hills oil fields. Now, four years later, diamond coring is being done in practically every active field and area in the state. The same trend has taken place throughout the entire country. Diamond coring is no longer in the experimental stage and for many operators it has become a routine part of drilling operations.

A great wealth of experience and knowledge has been gained during these four years. At this time, experimental changes in technique, design of core heads, types of diamonds, core barrels and other coring accessories are still being made in an effort to further improve diamond coring.

This article will endeavor to present a summary of all of the aspects of diamond coring and will necessarily deal in generalities. A complete paper could be written on each subject discussed.

SUMMARY OF DIAMOND CORING OPERATIONS IN CALIFORNIA. An effort was made to determine accurately the total amount of coring done in California. This was an impossible task since some operators would not release the necessary data and others had not maintained records of their coring. Fairly accurate records have been kept by some of the diamond coring service companies. From data furnished by them and by cross-checking with data furnished by some of the operating companies, it was possible to establish a partial tabulation of coring operations.

As shown in Table 1, in 32 fields or areas in the state, 109,506 feet of diamond coring was done using 493 heads. Many of the heads tabulated were still capable of additional footage. The depth of the coring has

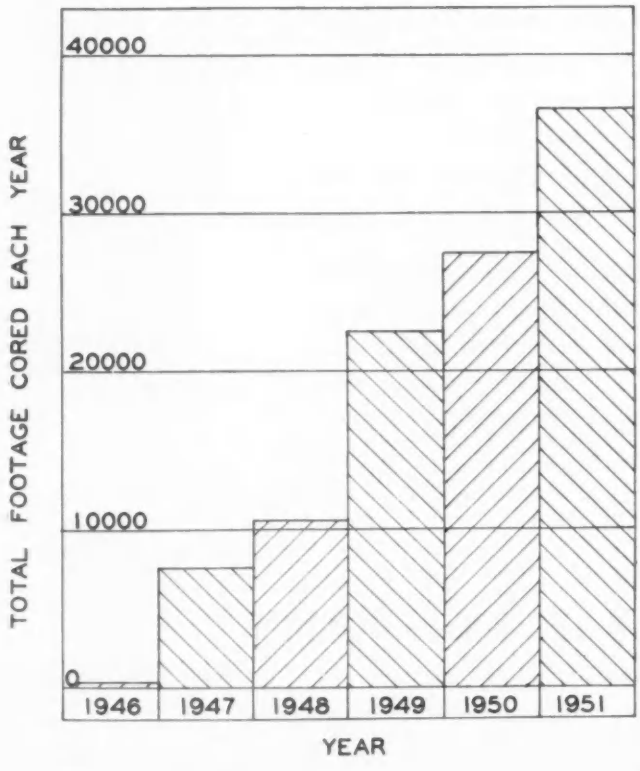

FIGURE 1. Diamond coring in California by years.

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ranged from as shallow as 150 feet to as deep as 14,000 feet.

The footage cored each year is shown in Figure 1. From a few hundred feet in 1946, the amount has increased steadily to about 36,500 feet in 1951.

In addition to the footage listed in Table 1, it is estimated that there was approximately 40,000 feet of coring for which data was not available. Some of this coring was in areas other than those shown.

Most of the coring was done through 7-inch casing using 5½-inch to 6⅛-inch heads. However, at the present time the largest percentage of the coring is being done with 8¼-inch to 8¾-inch heads through long sections of open hole.

Data Incomplete

In areas where the percent of core recovery was available the average recovery was 97.7 percent. In many cases the recovery was 100 percent.

Complete data were not available on rates of penetration, coring costs, types of drilling fluid and types of formation. However, in the discussion following special data on these items will be presented for certain areas.

SIZES AND TYPES OF CORE HEADS IN USE. The sizes of core heads that have been used have ranged from 5½ inches to 12¼ inches. The size most commonly used has been for 7-inch casing, or the 5⅞-inch, 6-inch, or 6⅛-inch head. Core heads are readily available now in any size desired. The size of the core cut is roughly half the size of the head. This ratio is variable and in some formations has proved to be very critical. The ratio may materially affect the rate of penetration, percent of core recovery, or the total feet cored per head.

Many types of core heads have been made and tested. These can be summarized, in general, as follows:

Shape of Crown: The crowns have varied from flat on the face with square edged at the gauge and at the throat, to fully rounded from the gauge through the crown to the throat. Between the two extremes there have been numerous combinations of varying radii from the gauge to the crown and from the crown to the throat. The effectiveness of the shape of the head may vary in some formations and it becomes a matter of trying several shapes to determine the one best suited for the formation being cored. In some cases, one shape of head will have a fast penetration rate, but, adversely, will have greater wear, whereas a different shape might have less wear but a slower rate of penetration. It thus becomes necessary to determine the most economical shape to use. In general, the slightly rounded edges are better suited to most areas and formations.

It has been found that, in most formations, the fully rounded head has a tendency to maintain a straighter hole than the square head. In one field the dips of the producing zone on one flank of the structure varied between 75 degrees and 90 degrees and the operator took advantage of the tendency of the square type head to deviate from vertical to drift the well up structure from a 5-degree inclination at the top of the zone to 25 degrees at the base. Thus, the well penetrated through the producing zone with much less footage drilled than normally would be necessary in a straight hole.

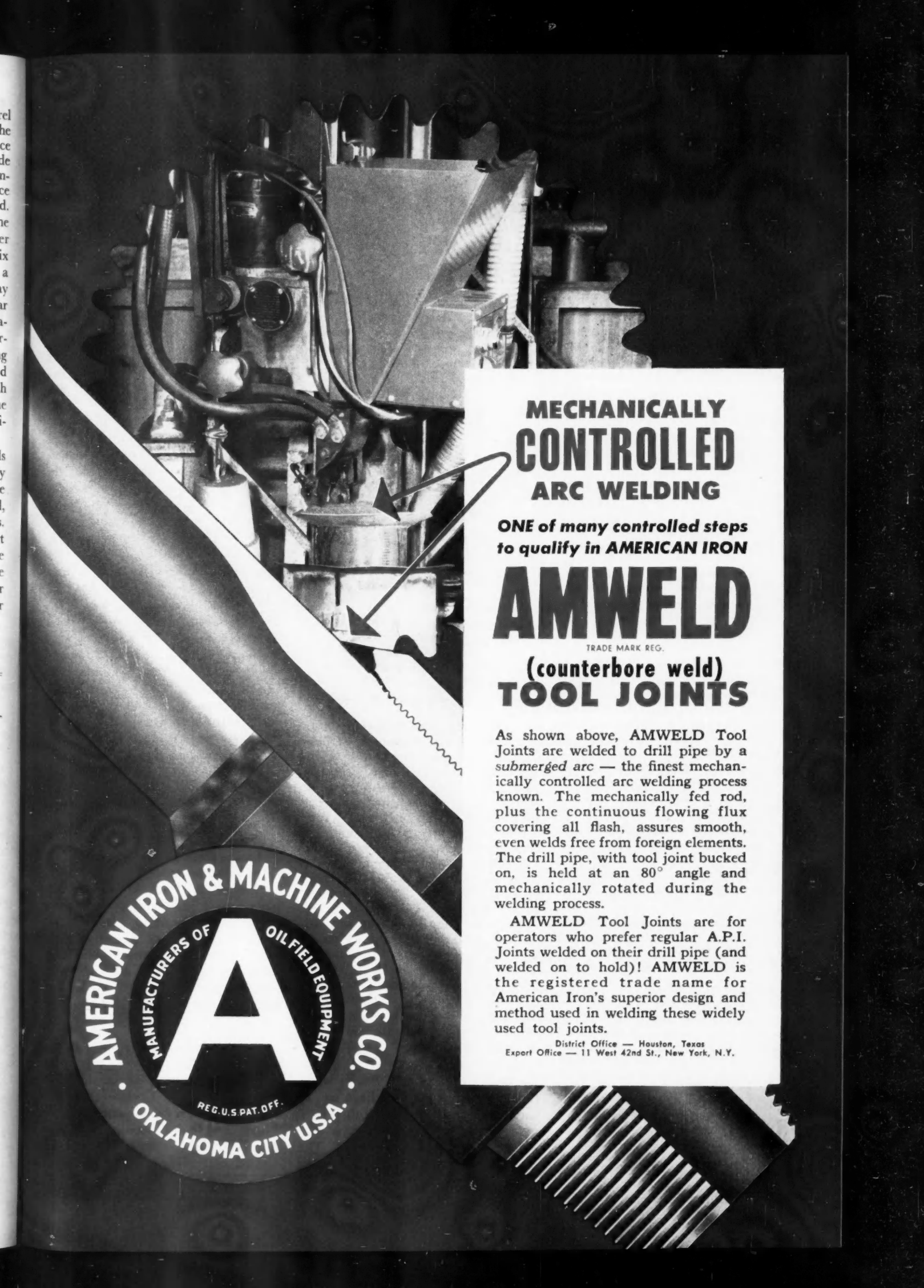
Waterways: The proper amount of fluid volume for which the waterways should provide is somewhat of a controversial subject. It is desirable to provide sufficient fluid volume to keep the face of the head clean, to remove cuttings from around the core barrel and from the hole, and to cool the head. If too great an area of the face of the head is removed to provide large waterways, then the fewer number of diamonds in the cutting face results in greater wear on the head. Too large a volume of fluid for the area of the waterways results in higher pump pressures, erosion of the matrix of the head, and, most serious, a hydraulic head off bottom that may cause a shattering or excessive wear of the diamonds. The makers of diamond core heads have done considerable field research and experimenting on this problem of waterways and they are able to furnish heads with the waterways designed to give the best performance for certain conditions.

The number of waterways on heads now in use varies from 0 to as many as 32, depending on the size of the head, the volume of fluid desired, type of formation and other factors. The most popular range is from eight to twenty. In combination with the regular waterways there is available a "face discharge." By means of larger diameter holes in the face, a greater

TABLE 1

Summary of Diamond Coring in California

FIELD or AREA	Average Depth	Type of Formation	Size of Core Head	Feet Cored	Percent Recovery	No. of Heads	No. of Fish Jobs
Buena Vista Lake	.....	.....	5⅞"–6"	1,110′	.....	3	....
Buena Vista Lake	.....	.....	10⅝"	211′	.....	1	....
Kern County	12,000′	Sand, Shale	5½"	173′	100%	2	1
Kern County	14,000′	Sand, Shale	5¾"	1,000′	100%	3	....
Coles Levee	9,000′	Sand, Sh., Chert	5⅞"–6⅛"	5,012′	.....	20	....
Coles Levee	.....	.....	10⅜"	211′	.....	1	....
Paloma	10,000′	Shale, Sdst., Sd.	5⅝"–6"	17,981′	.....	117	2
Paloma	10,000′	Shale, Sdst., Sd.	7⅝"	14,254′	.....	67	....
Kettleman Hills	7,800′	Sand, Shale	5¾"–6"	414′	100%	3	....
Guijarral Hills	9,000′	Sand, Shale	5⅞"–6"	6,662′	.....	23	....
Guijarral Hills	.....	.....	8⅜"	535′	.....	2	....
Huron	.....	.....	5⅞"–6½"	2,543′	.....	9	....
Jacalitos	2,600′	.....	6"–6⅛"	1,079′	100%	6	....
Coalinga Nose	9,400′	Sand	6"	17′	100%	1	....
Cantua Creek	2,200′	Sand, Shale	6"	660′	100%	1	....
Cuyama	.....	.....	5⅞"–6½"	1,395′	.....	7	....
Cuyama	.....	.....	7⅜"–7¾"	422′	.....	2	....
Elk Hills	.....	Sand, Shale	6"	422′	.....	2	....
Edison	.....	.....	8½"	295′	.....	1	....
Greeley	.....	.....	5⅞"	211′	.....	1	....
Midway-Sunset	1,800′	Sand, Shale	6"	1,000′	99.5%	1	....
Fellows	6,100′	Shale	6¾"	140′	100%	1	....
Kings County	9,000′	Sand, Shale	6"	1,206′	100%	2	....
Carizzo Plains	2,300′	Congl.	6¾"	10′	100%	1	....
Fresno County	9,500′	Sand	6"	405′	100%	1	....
Monterey County	.....	Congl.	6"	190′	100%	1	....
Santa Barbara Co.	2,400′	Congl.	8½"	149′	100%	1	....
San Luis Obispo Co.	.....	.....	9½"	29′	41%	1	....
Santa Maria	.....	Fractured Sh.	8½"	499′	.....	2	....
Ventura Avenue	10,000′	Sand, Shale	5¼"	150′	.....	1	1
Ventura Avenue	10,000′	Sand, Shale	5⅞"–6½"	9,127′	.....	26	....
Ventura Avenue	.....	.....	8¼"	901′	.....	4	1
Ventura Avenue	.....	.....	10¼"–10¾"	1,183′	.....	7	....
San Fernando	2,500′	Sand, Shale	6"	40′	75%	1	....
Castaic	9,000′	Congl.	5⅞"–6¾"	1,669′	87%	10	....
Castaic	9,000′	Congl.	7¾"–8½"	2,953′	100%	7	....
Fillmore	.....	.....	5 15/16"	211′	.....	1	....
Fillmore	.....	.....	8½"–8⅝"	2,907′	.....	8	....
Newhall-Potrero	11,000′	Congl., Sh.	5⅞"–6"	16,003′	97%	90	....
Newhall-Potrero	13,000′	Sh., Congl., Sd.	8¼"–8⅝"	5,394′	99%	20	....
Saugus	.....	.....	8¼"–8½"	.....	.....	3	....
San Diego County	.....	.....	8½"	211′	.....	1	....
L. A. Basin	.....	Sand, Shale	5 9/16"–6¾"	5,783′	99%	12	....
L. A. Basin	.....	.....	8¼"–9⅝"	2,621′	.....	11	....
Orange County	9,000′	Congl.	5⅝"–6½"	1,585′	96%	9	....
Total	.....	.....	.....	109,506′		493	
Coring data withheld	.....	.....	.....	40,000′ est.			
Grand Total	.....	.....	.....	149,506′			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volume of fluid can be circulated at lower pump pressures. This feature is desirable in certain formations to aid in removing cuttings from the hole where large volumes of fluid across the face of the head would otherwise be detrimental.

Joseph J. Sanna, in his paper Diamond Drilling Operations,[2] presented a graph of bit diameter versus fluid volume recommended for diamond coring. Table 2 summarizes that graph.

Pattern of Diamond Setting. Outstanding improvements in diamond coring have transpired as a result of research and experimentation in the method and pattern of setting diamonds in the head. The matrix now being used has the ability to hold the diamonds in place. It is rare that a complete diamond is lost from the head. Normally, two-thirds of the diamond is set in the matrix. Some heads are now being flush-set with the diamonds being completely buried in the matrix. Variations of this practice include flush-setting on the throat, on the gauge, or imbedding diamond chips or dust in the face of the matrix. Particularly good results have been obtained by flush-setting on the gauge, thus reducing the abnormal wear on the gauge caused by round trips through the well casing. If a head is completely flush-set the matrix should be softer to permit eroding of the matrix to maintain some exposure of the diamonds.

In setting diamonds on the face of the head it is necessary to provide for, (1) overlapping of diamonds in the path of rotation, (2) positioning of larger and stronger diamonds at points of most severe wear, (3) removal of cuttings, (4) predetermined waterways, (5) junk slots and (6) bit-breaker slots.

The diamonds should be set in the head so that not more than half of each diamond is presented to the formation being cored. This results in a smooth shearing of the formation instead of a detrimental bouncing action which occurs if each diamond is allowed to meet the formation directly. Thus, the general appearance of the face of most types of heads presents a spiral effect. In some heads this effect is accentuated by shallow grooving following the course of the spiral and other grooving across the face at right angles to the spiral, so that the diamonds appear to be set in individual squares of matrix. With this setting the removal of some cuttings may be facilitated by centrifugal force. In some formations this action could readily increase the economy of diamond coring while in others there would be no advantage or perhaps there would be a disadvantage. One type of head utilizes removable wedges. In this manner, worn or damaged segments of the head can be replaced as necessary without resetting the complete head.

When a new head is made up the larger diamonds generally are placed in the position in the head that experience has shown to be subject to the most wear. When a head is reset the salvaged diamonds have to be carefully inspected to select the better ones to be used with the new diamonds necessary for the reset. The care and attention given to this detail by the manufacturer can materially increase the results obtained. Several split diamonds in one path of rotation can start a groove on the head that would rapidly lead to a completely cut out ring.

In designing the head, the removal of cuttings must be considered. These can be removed by means of the spiral grooves previously mentioned, or through the small space between the matrix and the depth to which the diamonds are buried in the formation. In either case the cuttings are moved to the nearest waterway and then are circulated away from the face of the head. If the cuttings are not removed quickly the head will continue to grind them up causing additional unnecessary wear.

Knowing the volume of fluid to provide for in the waterways, it is important to design them so that there is no interference in offsetting the paths of the diamonds or the removal of cuttings. The shape and position of the waterways are important factors in the ability of the head to withstand wear and also affect the rate of penetration. Waterways have been made in many combinations of widths and depths, the most common being about ¼-inch wide by ¼-inch deep. The position of the waterways, in most cases, has been at 90-degree angles across the face. Some have varied as much as 30 degrees from the right angle, placed so that the cuttings and fluid are spun away from the direction of rotation. One type of head was designed with the waterways placed in a slanting "S" shaped pattern. The manufacturers have eliminated the types of waterways found to be ineffective and now have determined the best combinations to go with their particular heads for certain formations.

Most of the heads now being made have 2 to 4 junk slots placed in the gauge of the head to remove small pebbles, cuttings or pieces of junk from the head. In some heads, these junk slots serve also as bit-breaker slots. In other heads the bit-breaker slots are placed in the side of the bit shank.

TYPES OF DIAMONDS IN USE. Of the several kinds and types of diamonds used in core heads the more common are the Congo, the West African Bortz (commonly called Bortz) and the Carbonato.[3] All diamonds not usable as gem stones are named bortz. The Congo Bortz dia-

TABLE 2

Volume of Circulating Fluid

Bit Diameter (in Inches)	Practical Maximum (Gallons Per Minute)	Minimum Desired (Gallons Per Minute)
3	75	16
4	140	25
5	210	37
6	300	50
7	360	66
8	440	85
9	520	120
10	575	145
11	620	175
12	665	210

About the Author

HAROLD M. STANIER was born in Pittsburgh, Pa., Nov. 28, 1907. Following graduation from Los Angeles High School in 1926, he attended University of California from which he was graduated in June, 1931, with a degree of Bachelor of Science in Petroleum Engineering. He joined Barnsdall Oil Company in 1936 as petroleum engineer and production foreman and, in 1948, was transferred to the drilling department of the company as California Division Development Engineer. In July, 1950, Barnsdall Oil Company was merged with Sunray Oil Corporation and he has continued in the same capacity with Sunray. Stanier is a member of Sigma Phi Delta professional social fraternity, Sigma Gamma Epsilon honorary fraternity and American Institute of Mining and Metallurgical Engineers.

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mond derives its name from the Belgian Congo where it is mined. Likewise, the West African Bortz is mined in West Africa. The Carbonato Bortz diamond comes from Brazil.

The West African Bortz has planes of cleavage which cause it to be subject to breakage along these cleavage planes. The Congo Bortz is a conglomerate mass and does not have cleavage planes. The fine crystalline structure and the frequent changes of direction of the grain structure of the Congo Bortz will often allow the point of the diamond to crumble. This makes the Congo appear softer than the West African Bortz but it will not crumble or split. However, it will "polish off" in a manner that leaves no sharp cutting edges. This is an ideal diamond to use at the points of most severe wear but is sometimes unsatisfactory when used on the face because, with usage, these diamonds may become too smooth to cut efficiently.

In salvaging diamonds from used heads, the Carbonato has the greatest percent of recovery because of its amorphous structure. The Congo also has good recovery while the West African Bortz has very poor recovery because of its tendency to chip and split.

The cost per carat and the relative size of the different diamonds are shown in Table 3.

The most common practice has been to set all of one type of diamond in a head, generally either Congo or Bortz. However, due to the different characteristics of the diamonds, there is much merit in using a combination of several types of diamonds in the same head. It is now fairly common to use Congo or Bortz diamonds set in the face and throat with about 8 percent of the total carat weight of Carbonato diamonds set in the gauge. This method, combined with flush setting the diamonds in the gauge, has greatly reduced the wear at that point in many instances.

Some formations have been cored economically by using tungsten pellets in place of diamonds. The initial cost of this type of head is considerably less, but normally much less footage would be obtained from the head and in most cases it would be uneconomical.

TABLE 3

Type of Diamond	Cost	Carats Per Stone	Percent Used
Belgian Congo	$6 to $9	½ to ¾	80
West African Bortz	$8 to $10	1/10 to ¼	10
Brazilian Carbonate	$15	1/10 to ¾	5
Others	$5 to $20	1/10 to 1	5

The problem of selecting the types and total carat weight of diamonds to use in a head for any particular formation is one that is solved mainly by experience. When extremely hard formations are anticipated, heads are often set with a greater concentration of better quality diamonds. This increases the initial cost of the head but very often results in less cost per foot for the coring. If an appreciable amount of coring is to be done in a well or area, it is generally profitable to experiment by varying the total carat weight and the type of diamonds in a number of different types of heads. The results should be judged by the total cost per foot of hole cored, including rig-time, and not by the cost per foot for the head as the rate of penetration will materially affect the total cost per foot.

SELECTION OF TYPE OF CORE HEAD TO USE. The formations encountered by the drilling bit in California are extremely varied in composition, occasionally being faulted or presenting rather steep dips. They range in hardness from soft shales that may be penetrated as fast as 3500 feet per day to consolidated granitic conglomerates through which only 4 or 5 feet per day may be drilled. Most of the producing formations are sands varying from a loose runny sand typical of the west side of San Joaquin Valley to an extremely hard or dense fractured sandstone such as the Knoxville sandstone in the Santa Maria Valley field. Production is obtained from other formations, such as: Fractured schist, heavy conglomerate, fractured shale and chert, and even basalt. In any particular field or well, the character of the formation may vary markedly with depth as well as laterally. For instance, in coring a zone, one well might penetrate several hundred feet of conglomerate interbedded with streaks of hard shale, oil sand and calcareous shell, whereas, another well several locations away might find the same zone composed of only friable oil sand with streaks of shale.

In practically all areas of California any slow or hard drilling might be diamond cored economically. The first problem is to determine if coring is advisable or worth a trial. The information available from operating companies, drilling contractors or manufacturer's representatives will be invaluable in making this decision if the operator concerned does not have sufficient experience of his own.

After it is decided to core rather than drill, the problem of selecting the most suitable core head and core barrel is more critical but perhaps easier. Knowing that no one type of head is efficient for all formations, one can be selected that is known to be able to core the general type of formation. As subsequent coring is done it is wise to try a few of the many variations available as to the shape of crown, number and shape of waterways, quality and setting of diamonds, etc. If accurate records are maintained it should be possible to evaluate the various types of heads and to determine finally the most efficient head for the area. The total cost per foot cored should be considered. This cost should include rig time, labor, supplies, core barrel rental and the net cost of heads after diamonds are salvaged. A quick, easy method of evaluating the various types of heads is to determine the cost per foot of the core head only. This method is fairly accurate if the rate of penetration remains about the same.

WHEN TO HAVE CORE HEAD RESET. This subject is one that has remained without a definite criterion. There is no decision to make if the head is grooved, cut out or otherwise damaged. However, if the head has a normal wearing off of the diamonds and matrix, it is difficult to determine the remaining footage left on the head. If the progressive wearing on each run is noted, there might be an indication of the rate of wear in uniform formations. The wear of the head after each run cannot be accurately measured except on the throat and gauge. Often there is a noticeable indication of greater wear, or a number of diamonds missing or sheared off, along a certain course. This is a good warning that a groove is beginning to develop. In most cases, it is usually a matter of experience and judgment in deciding when to have the head reset. Perhaps the best "rule of thumb" to use is that if there is any doubt about the head being capable of making another run, have it reset.

Sufficient data is available to show that, on the average, over 50 percent of the diamonds have been salvaged, with many individual cases being 60 percent to 70 percent. A number of heads have been set with the cheapest diamonds available and then run to destruction without any salvage of diamonds. The economy of this practice is questionable. However, it has been profitable in a few certain areas.

(First of Two Parts)

REFERENCES

[1] "Recent Diamond Coring in California," by W. C. Harrington and Max C. Eastman, API Drilling and Production Practice, 1948.

[2] "Diamond Drilling Operations," by Joseph J. Sanna, The Oil and Gas Journal, May 18, 1950.

[3] "Relative Economics of Diamond Coring and Drilling," by C. Deely, WORLD OIL, May, 1950.

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Rotational Viscometer Modified to Multi-Speed Instrument Provides Operator With a Simple and Convenient Apparatus For the Measurement of Plastic Viscosity and Yield Value

By J. C. MELROSE and W. B. LILIENTHAL

Magnolia Petroleum Company

THE highly complex drilling fluids which are required for deep drilling often give rise to new and unusual mud control problems. Rapid and economic solutions to these problems may require, on the one hand, better understanding of the changes which contaminants and chemical treating agents produce in the colloidal and inert solids of the mud, or, on the other hand, closer control of the hydrodynamic behavior of the mud. The latter objective obviously can be achieved only if a correct rheological analysis of the flow behavior of drilling muds is available and if this is accompanied by the appropriate rheological measurements. The purpose of this paper is to describe such measurements in the field, and to show how the resulting data can be of value in solving difficult mud control problems.

It is now generally recognized that Bingham's law of plastic flow can be utilized in describing the hydrodynamic behavior of drilling fluids in the non-turbulent flow range. Beck, Nuss, and Dunn[1] have recently applied this law to the flow of mud in small pipes, and Rogers[2] has reviewed the rather extensive literature on this subject. So far, however, the use of Bingham's law has been restricted to the analysis of mud flow in pipes or capillary tubes, and it has not been directly applied to the flow in rotational viscometers. In the work to be reported, the Reiner-Riwlin[3] equation for the flow of a plastic fluid in a rotational viscometer has been utilized to permit the expression of multi-speed viscometric data in terms of plastic viscosity and yield value, the two absolute flow properties of a plastic fluid.

With regard to the application of these measurements, the calculation of the relationship between pumping rate and pressure drop, both in the drill pipe and annular space, has long been a subject of interest. Beck, Nuss, and Dunn,[1] following Caldwell and Babbitt,[4] base their calculations for non-turbulent flow on Buckingham's integration of Bingham's law for pipe flow and measurements of the plastic viscosity (rigidity in their terminology) and yield value. In the case of turbulent flow, Fanning's equation is employed, and the pressure drop is relatively insensitive to the flow properties of the mud. Since flow in the drill pipe is likely to be turbulent at usual circulation rates, the plastic flow properties will chiefly influence the pressure drop in the annular space. As pointed out by Beck,[1] the control of this component of the total pressure drop may be of special importance where lost circulation problems are encountered. Other hydrodynamic problems to which it should be possible to apply measurements of the plastic flow properties include predictions of the velocity distribution in non-turbulent flow and the critical velocity for transition to turbulence.

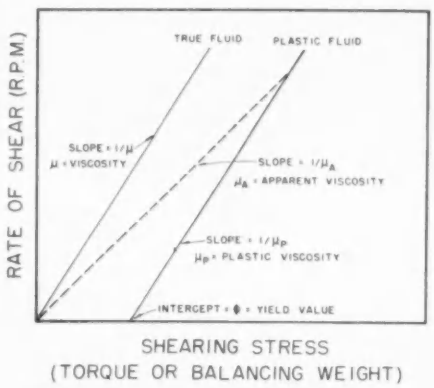

FIGURE 1. Flow diagram for plastic fluids.

Plastic viscosity and yield value, as absolute flow properties, will reflect the colloidal or surface-active behavior of the solids present in drilling fluids. Measurements of these properties should therefore find application in developing a better understanding of such behavior and in characterizing the type and condition of these solids. Garrison and ten Brink[5] have utilized multispeed viscometric data in this manner, although their measurements were not expressed in terms of the absolute flow properties.

In connection with the application of these measurements, it should be recognized that the presently used one-point viscosity measurements are relative in nature. The API Stormer 600-revolutions per minute measurement, for example, is a function of both plastic viscosity and yield value, as well as mud weight, and will often be misleading when its application to

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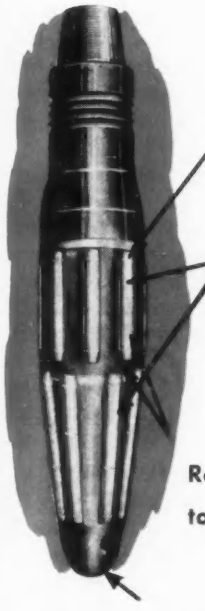

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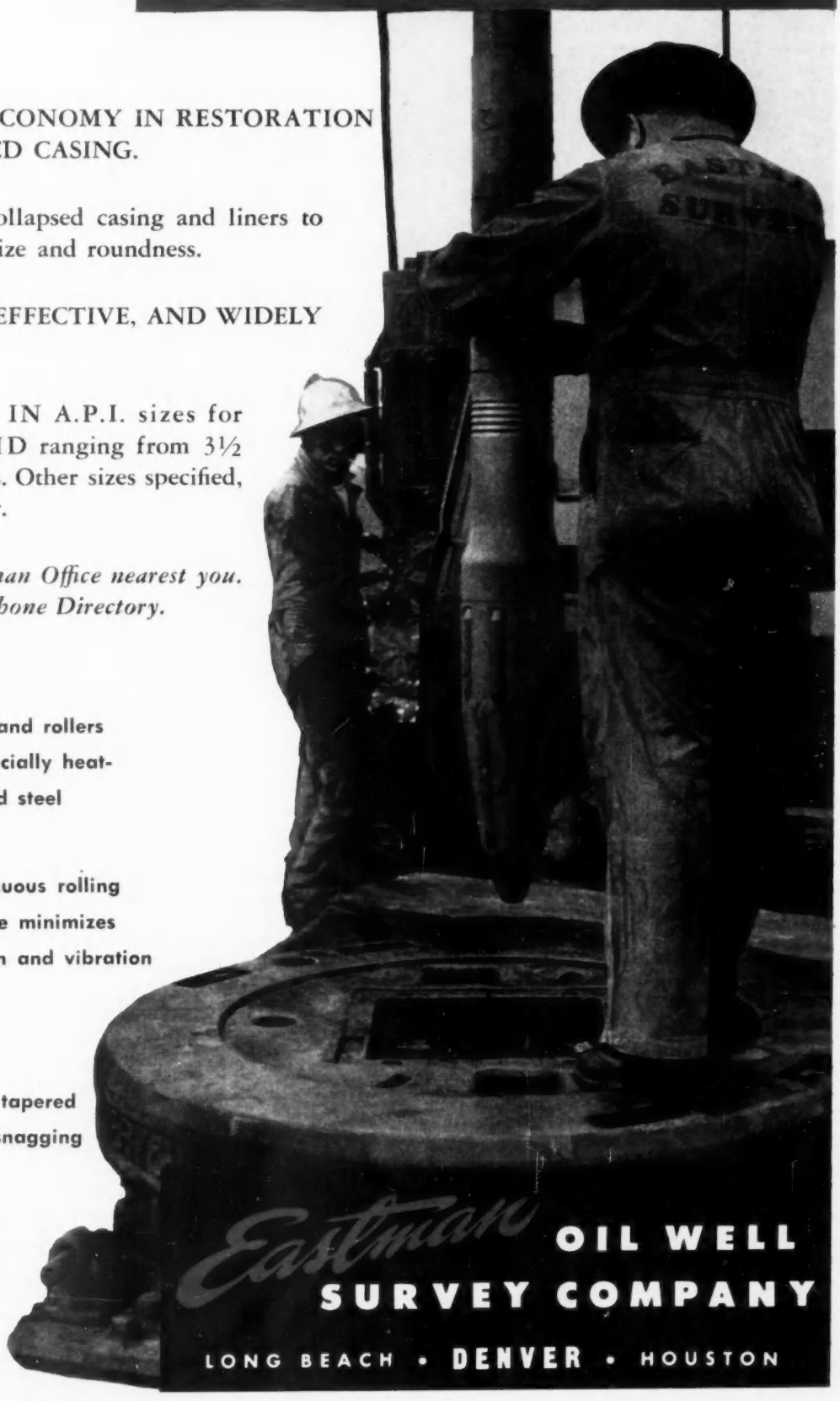

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mud control problems is attempted.

Figure 1 gives an idealized plot of the flow variables involved in any viscometric measurement. It is seen that the flow behavior of plastic fluids is characterized by two constants—plastic viscosity, μ_p, and yield value, ϕ. Other workers have used the term rigidity for plastic viscosity or the term mobility for its reciprocal. The term plastic viscosity, however, emphasizes the close relation this property bears to the viscosity of a true fluid and is expressed in the familiar viscosity units of centipoises. The yield value is expressed in pounds per 100 square feet, the units adopted for gel strength measurements with the API shearometer.

Definitions of these properties based on rheological or microscopic flow considerations follow from Figure 1. The plastic viscosity of a substance obeying Bingham's equation is defined as the constant ratio of a given change in the shearing stress to the corresponding change in the rate of shear when the body is undergoing permanent deformation or flow. This same definition applies also to the viscosity of a true or Newtonian fluid. The yield value of a plastic substance may be defined as the difference between the shearing stress and the product of the plastic viscosity and rate of shear. If Bingham's law is obeyed at very low rates of shear, the yield value is also the shearing stress which must be exceeded for permanent deformation or flow to take place.

Plastic Flow, Plug Flow and Thixotropy

Several aspects of the plastic flow of drilling fluids deserve comment before proceeding to a description of the instrument used in the present work. First, at some low rotor speed (usually below 100 rpm in any practical viscometer), a curvature toward the origin will occur in the linear relationship between rotor speed and stator torque (see Figure 1). This curvature, often referred to as the plug flow region, has been shown by Reiner and Riwlin,[3] in the case of a fluid obeying Bingham's equation, to begin when the yield value exceeds the shearing stress at the wall of the outer cylinder of a rotational viscometer. Thus, the phenomenon of plug flow is characteristic of and not a deviation from the behavior of a "Bingham body." It should be stated, however, that deviations from Bingham's law are to be expected in this low shear rate range in the case of systems, such as most drilling muds,

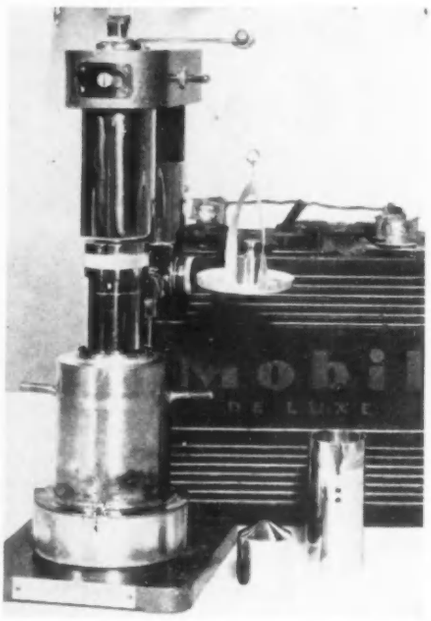

FIGURE 2. Multispeed viscometer, field model.

which show highly time-dependent gel strength properties.

The existence of such time effects, generally referred to as thixotropy, introduces the second complication encountered in observations of the laminar flow behavior of drilling muds. Several workers[6] have proposed the use of "hysteresis loop" and "thixotropic level" concepts to characterize systems showing such effects. It has been observed by the authors, however particularly in the case of highly chemically treated field muds, that equilibrium torque readings with a rotational viscometer may be reached in a matter of a few minutes, provided that each such reading is preceded by an equilibrium at a higher rotor speed. (At a constant rotor speed the torque will then increase toward the equilibrium value; the opposite occurs if the reading is preceded by an equilibrium at a lower speed, and somewhat longer times are involved). These observations indicate that the mud flow in field systems, in situations where a simple laminar type of flow is expected to prevail, may be very nearly at a steady state, as defined by equilibrium torque readings.

If characterization of the "thixotropic property" of the mud is desired, it is felt that this may be furnished by measurements of the increase in gel strength with increasing periods of rest time. Some of the complications which arise in obtaining such measurements have been discussed by Cardwell.[7] Slippage, probably caused by syneresis, may also be a serious problem when rest times of the order of 30 minutes or longer are involved. The authors believe that the usual techniques for avoiding these difficulties cannot be easily applied to instruments suitable for field measurement of the plastic flow properties defined above and that gel strength data can best be obtained with an instrument designed specifically for such measurements. Mud problems which require this type of rheological analysis include the prediction of bottom hole pressure surges developed by up and down swabbing and when breaking circulation, as well as the prediction of the ability of the mud to suspend cuttings on shutdown.

Instrument Development

In plotting data obtained with a rotational viscometer according to the scheme of Figure 1, i.e., viscometer rotor speed (rate of shear) versus the torque on the stator (shearing stress), a straight line will result for a plastic and thixotropic fluid if two requirements are met: first, that the viscometer be run long enough at each speed to reach an equilibrium torque reading; and second, that the design of the viscometer rotor and stator be such that a strictly linear calibration relationship results, i.e., kinetic energy and end effects are absent. (These effects also introduce a density dependence, as in the Stormer viscometer).

In addition to giving a straight-line plot of the observed data, a suitable viscometer should possess sufficient compactness, ruggedness, and simplicity of operation for use in the field as well as in the laboratory. Precision and reproducibility should be of the order of ± 2 percent.

A survey of rotational viscometers which were available commercially revealed that none of them completely filled the requirements set forth above. Experimentation with the Stormer viscometers, the rotational viscometer most commonly used in oil field work, indicated that it was unsatisfactory for adaptation to such purposes. One commercially available viscometer, the Fann V-G Meter, met all of the desired requirements with the exception of the multispeed feature, so it was decided to alter this instrument accordingly. This viscometer, employing a motor-driven outer cylinder turning around a stator that could be balanced to a null point by means of suspended weights, had a number of very desirable features: compactness, a rugged bearing system, a 6-volt d.c. motor for use with an automobile storage battery, and a suitable rotor and stator design.

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obtained by substitution of a variable speed type CRX governor unit, made by Lee Engineering and Manufacturing Company, Milwaukee, for the constant-speed governor supplied with the motor. It was necessary to lengthen the motor housing by about two inches in order to install a manually set cam-driven push-rod control for the governor. By adjustment of this mechanism, rotational speeds of approximately 600, 500, 400, 300, and 200 rpm could be set, maintained, and duplicated.

Figure 2 is a photograph of the instrument with the rotor partially immersed in a water-jacketed sample container. The disassembled stator and rotor are shown at the side of the instrument. A high speed switch on the left side of the gear housing operates a governor release mechanism, making available a top, uncontrolled speed of about 1100 rpm. In order to obtain equilibrium torque readings, the mud sample is first sheared at this speed for about a minute, after which torque readings can be made at successively lower speeds. Usually, when making such a "down curve," the equilibrium torque will be reached in about the length of time required for adjusting the balancing weight.

The calibration of a multispeed rotational viscometer for use with plastic fluids can best be accomplished with a series of true fluids of known viscosities. The test fluids used in calibrating the viscometer described above were glycerol-water solutions, the viscosities of which had been determined with Fenske-Ostwald capillary viscometers. A linear calibration relationship was found, indicating that kinetic energy and end effects were negligible as desired. This relationship is described by the equation:

$$\mu = \frac{AG}{Z} \qquad (1)$$

where

μ = viscosity, centipoises
G = balancing weight (torque), gms
Z = rotor speed, rpm
A = calibration constant

The constant A determined from the calibration data may be compared with a theoretical value calculated from the dimensions of the viscometer by means of the Couette-Margules equation.

In the case of plastic flow the above variables are related by the equation:

$$\mu_p = \frac{AG - B\phi}{Z} \qquad (2)$$

Since calibration fluids for plastic flow do not exist, the constant B must be determined from the little-known equation of Reiner and Riwlins[3] for the flow of a plastic fluid in a rotational viscometer, which gives

$$B = \frac{(100)\ (30/\pi)\ ln\ (r_c/r_b)}{(0.20886)} \qquad (3)$$

where

r_c = radius of outer cylinder, cm
r_b = radius of inner cylinder, cm
$30/\pi$ = factor for converting from rad/sec to rpm
100 = factor for converting from poises to cp
0.20886 = factor for converting from dynes/cm² to lbs/100 sq ft

Equation (2) may conveniently be applied to the calculation of plastic viscosity and yield value from experimental data on drilling fluids if the data are plotted as in Figure 1. Denoting the intercept on the balancing weight (torque) axis, where $Z=0$, as G_0, and the weight reading at the highest speed available as G_{max}, Equation (2) may be solved as follows:

where

$$\mu_p = k_1(G_{max} - G_0) \qquad (4)$$

$$\phi = k_2\, G_0 \qquad (5)$$

where

$k_1 = A/Z_{max}$
$k_2 = A/B$

The accuracy of the calibration constant A determined as described was ±1 percent. In the case of routine measurements of mud, employing a procedure suitable for use in the field, there are two main factors other than the previous history of the sample which affects the reproducibility of results with a given instrument. The first is the technique of the operator, and the second is the judgment employed in drawing a straight line through the data on the rpm versus balancing weight plot. With reference to the first factor influencing reproducibility, tests were made on a series of 26 widely different laboratory-prepared muds, data on each mud being obtained independently by two or three operators. Results from these tests gave an average deviation from the mean of the two or three observations of about ±3 percent for both plastic viscosity and yield value. Deviations resulting from different individuals plotting the data amounted to approximately 2 percent for the plastic viscosity and 5 percent for the yield value.

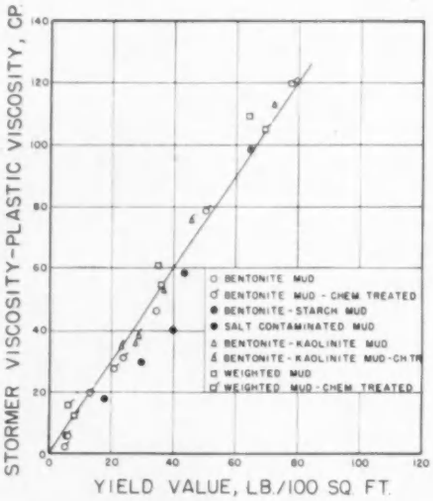
STORMER VISCOSITY-PLASTIC VISCOSITY, CP
YIELD VALUE, LB./100 SQ. FT.
BENTONITE MUD
BENTONITE MUD - CHEM. TREATED
BENTONITE - STARCH MUD
SALT CONTAMINATED MUD
BENTONITE - KAOLINITE MUD
BENTONITE - KAOLINITE MUD - CH.TR.
WEIGHTED MUD
WEIGHTED MUD - CHEM. TREATED

FIGURE 3. Correlation of Stormer viscosity with plastic flow properties.

Deviations from linearity in the rpm versus balancing weight plot, *i.e.*, from ideal plastic flow at the rates of shear used, have been within the indicated accuracy of the method except in cases where solids are settling rapidly in the sample. However, in this event, valid viscosity measurements are impossible to make with any type of rotational viscometer.

Experimental Results

In order to show how measurements of the plastic flow properties of muds, as obtained with the multispeed viscometer, may be utilized, the results of several laboratory investigations will be presented. The first investigation was carried out for the purpose of establishing relationships between the multispeed viscometric measurements and those now in common usage, while the second was concerned with the response of the plastic flow properties to chemical treatment.

Twenty-six muds prepared in the laboratory, and representing a variety of mud systems, were used in the first investigation. During the preparation and testing of each mud, special efforts were made to insure identical handling and measuring procedures, in order to minimize any variations which might be due to such factors; each measurement was checked by two or three operators. The correlations which were found between the various viscometric measurements are shown in Figures 3, 4, and 5.

In the case of the correlation of the Stormer viscosity with the plastic flow properties (Figure 3) and the Stormer-multispeed viscometer initial gel correlation (Figure 4), straight-line relationships were found. As indicated in Figures 3 and 4, these relationships are not greatly dependent on the mud system, except for the case of the salt-contaminated mud. The correlations of the initial and ten-minute gels and the initial shear strength with the yield value, on the other hand, resulted in power functions, which were affected by the type of mud system. The actual data are not shown in Figure 5, since the

average deviation from the plotted lines was of the order of 25 percent.

Chemical Treatment Studies

In the investigation of the effect of chemical treatment on the plastic flow properties, a bentonite-kaolinite base mud containing about 30 weight percent solids was prepared and treated with various qualities of quebracho, sodium hexa metaphosphate, and sodium acid pyrophosphate. Figure 6 shows the effect of added quebracho on plastic viscosity, yield value, and Stormer viscosity. Similar curves were obtained for the phosphate treatments. It is seen that "viscosity reduction" by chemical treatment is accomplished entirely by a reduction in the yield value, while the plastic viscosity actually increases somewhat.

Since the plastic viscosity of a mud is not reduced by chemical treatment, the higher the plastic viscosity/yield value ratio, the less is the susceptibility of the mud to chemical treatment. This concept is illustrated in Figure 7, in which plastic viscosity is plotted against the yield value for a large number of muds which are available in the laboratory. The compositions of these muds fall into four groups, which may be described as follows:

1. High-solids muds including bentonite-kaolinite systems, native clays, and salt water clays.
2. Bentonite-water muds.
3. High-solids muds containing 3 percent bentonite and varying percentages of Gulf Coast shale.
4. Alkaline-tannate-lime muds, representing samples over the entire mud weight range from 9.0 pounds/gallons (67.2 pounds/cubic feet) laboratory-prepared muds to 18 pounds/gallons (134.4 pounds/cubic feet) field muds. While some were starch muds, all had been treated with caustic soda, quebracho, and lime.

From Figure 7 it may be seen that these groups give a family of curves corresponding to different susceptibilities to chemical treatment, as defined above.

DISCUSSION AND INTERPRETATION OF RESULTS

CORRELATION WITH STORMER MEASUREMENTS: It is well known that any single point viscosity measurement on a plastic fluid, such as the Stormer 600-rpm reading, is actually an apparent viscosity, *i.e.*, a value equivalent to the viscosity of a true or non-plastic fluid giving the same observed stress reading as the plastic fluid at the particular rate of shear chosen (see Figure 1). Thus, Equations (1) and (2) may be combined to define such an apparent viscosity, μ_a, in terms of the plastic flow properties:

$$\mu_a = \mu_p + (B/Z)\phi \qquad (6)$$

This equation also shows that the apparent viscosity varies linearly with the reciprocal of the rotor speed, Z, as is illustrated by the data of Garrison and ten Brink[5] and Bednarski.[8] Where the apparent viscosity versus reciprocal rpm plots given by these workers are linear, it is indicated that the muds investigated obeyed the law of plastic flow.

The correlation of the Stormer viscosity, μ_s, with the plastic flow properties is shown in Figure 3 to be of the form predicted by Equation (6) when μ_s is substituted for the apparent viscosity. The deviations of the data from a single relationship are smaller than would be expected from a consideration of the peculiarities of the Stormer design, such as a considerable density dependence due to kinetic energy and end effects and the opportunity for the existence of a non-flowing plug inside the rotor.

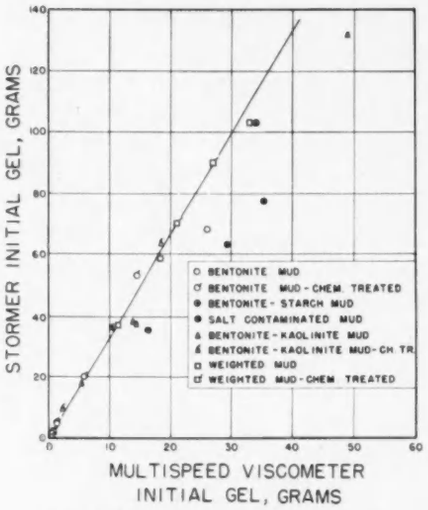

FIGURE 4. Correlation of initial gels.

In the case of the Stormer-multispeed viscometer initial gel correlation (Figure 4), a correlation of the expected form was also found. The proportionality factor was close to that calculated from the respective viscometer dimensions. The correlations of Figures 3 and 4 may be used where approximate conversions from multispeed viscometer data to Stormer data are required.

The reason for the power functions obtained for the correlations of Figure 5 is not known. When the Stormer initial gel strength values are converted to the units of pounds/100 square feet, the data of Figure 5 show that the initial gel strength and initial shearometer reading are both less than the yield value, all three measurements being expressed in the same units. This confirms previous reports[7] that at very low rates of shear Bingham's law is no longer followed. It is felt, however, that this fact does not constitute a limitation of the usefulness of measurements of the plastic flow properties with regard to those applications which were mentioned above, since the yield value measured by the present method, together with the plastic viscosity, determines the relationship between the rate of shear and shearing stress throughout most of the range of laminar flow.

APPLICATION TO CHEMICAL TREATMENT: In developing explanations for the changes in plastic viscosity and yield value with addition of deflocculating agents, it is helpful to give a partial and limited interpretation of these two viscometric properties in terms of the colloidal or sub-microscopic structure of drilling muds. From the purely rheological definitions of these properties given above, it may be seen that in the case of a plastic fluid such as a drilling mud the frictional resistance to flow, measured by the shearing stress or viscometer torque reading, is composed of two parts (see Figure 1). The first is proportional to the rate of shear and thus is largely the resistance to flow due to the mechanical friction of the particles.

Since the plastic viscosity is a measure of this proportionality, this property will be a function of solids concentration and shape, as predicted by an extension of Einstein's equation for the hydro-dynamic interaction effects of dispersed solids on the viscosity of a suspension.[9] If the particles carry an electric charge, the plastic viscosity might also be expected to increase with decreasing particle size, as

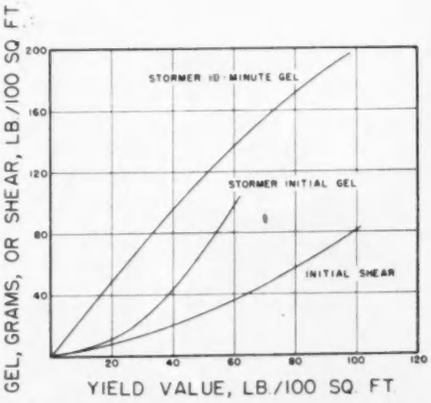

FIGURE 5. Correlation of initial and ten-minute gels with yield value.

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described by Smoluchowski's modification of Einstein's equation. Since the action of deflocculating agents or "viscosity reducing" chemicals should not produce more symmetrical or larger particles, but rather the opposite, it would be expected that reduction of the plastic viscosity by such treatment would be difficult if not impossible. The observed increase in plastic viscosity (Figure 6), on the other hand, can be explained as the result of dispersion of clay aggregates in the mud.

The second type of resistance to flow is independent of the shear rate and is due to the "gel forces" acting between the particles of the suspension. It is believed that both attractive and repulsive forces are operative, the latter originating primarily from the electrical charge carried by the particles. This component of the total resistance to flow is measured by the yield value, which may then be expected to be a function of the concentration of the mud solids and those factors, such as surface charge and potential, which affect the interparticle forces. Since deflocculating agents are thought to adsorb on the solid particles, thus altering the chemical nature of their surfaces and affecting the interparticle forces, the "viscosity reduction" due to such chemical agents should be almost entirely the result of a decrease in the yield value, as is observed.

APPLICATION TO PRESSURE DROP CALCULATIONS: One of the primary aims of chemical treatment of muds is, of course, to control the hydrodynamic behavior upon which several of the most important functions of muds are based. In this connection the plastic flow properties measured as described above may be used to predict pressure drops in certain cases of laminar flow. It should be noted that the Buckingham equation for pipe flow cannot be used to describe flow in an annulus, even if the equivalent diameter (four times the hydraulic radius) is substituted for the pipe diameter.[10] Drill pipe rotation will obviously cause further complications in the case of flow in a well annulus.

Another factor which is often overlooked is that if the temperature of the mud sample at the time of measurement is considerably different from average well conditions, corrections for the effect of temperature on the plastic flow properties should be made. In the case of water-base muds, the magnitude of the correction for the plastic viscosity may be estimated from the effect of temperature on the

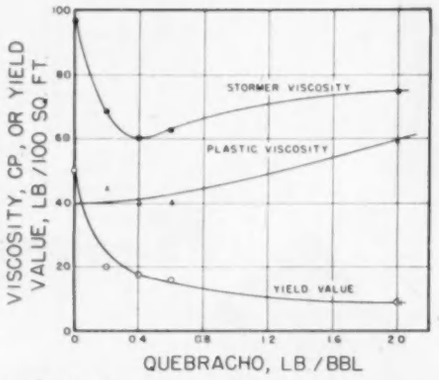

FIGURE 6. Effect of quebracho treatment on bentonite-kaolinite mud.

viscosity of water. Such a consideration indicates that for a difference of 80°F between the average well temperature and the temperature at which the mud is measured, the correction plastic viscosity will be of the order of half the measured value. Since the slope of the apparent viscosity reciprocal rpm plot for a drilling mud is proportional to its yield value [see Equation (6)], the data presented by Bednarski[8] show that the effect of temperature on the yield value varies widely among different muds and in some cases the yield value at 160°F may be twice that at 80°F.

These estimates of the effect of temperature have been applied to a pipe flow pressure-drop calculation for a mud of 20 centipoise plastic viscosity and 10 pounds/100 square feet yield value, as measured at 80°F. The result was a pressure drop 60 per cent higher than that calculated from the measured properties.

CONCLUSIONS

● A commercially available rotational viscometer modified to perr multispeed operation, has a straigh line calibration and is sufficiently rugged for field as well as laboratory use.

● The behavior of water-base drilling fluids in this viscometer with few exceptions is described by the law of plastic flow, provided that equilibrium torque readings are obtained. The steady-state laminar flow behavior of muds is therefore characterized by the variables, plastic viscosity and yield value.

● The measurements with the multispeed viscometer are approximately related to Stormer viscometer measurements by the following equations:

$$\mu_s = \mu_p + 1.5\phi$$
$$G_S = 3.3\, G_F$$

where

μ_s = Stormer 600 rpm viscosity, cp
μ_p = plastic viscosity, cp
ϕ = yield value, lbs/100 sq ft
G_S = Stormer initial gel, gms
G_F = multispeed viscometer initial gel, gms

● The plastic flow properties may be interpreted in terms of the concentration and surface properties of the solids present in the mud. Such considerations can be used to explain the action of chemicals in "viscosity reduction" and suggest that the susceptibility of a mud to chemical treatment can be predicted from plastic viscosity and yield value data.

● The pressure drop of a mud in laminar flow, *e.g.*, in a well annular space, will depend on the plastic flow properties. In order to make pressure drop calculations, knowledge of the effect of temperature on the plastic flow properties is required, since the yield value at average well temperatures may be considerably greater than that measured at the surface.

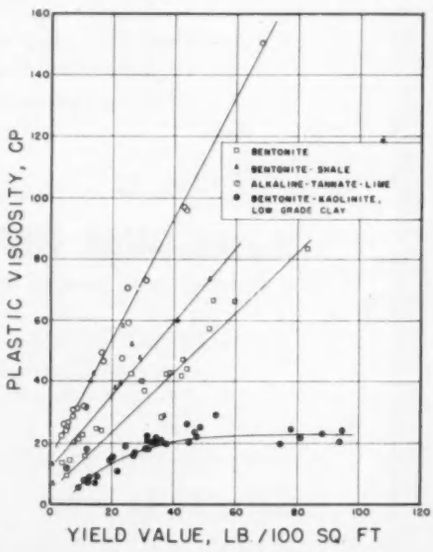

FIGURE 7. Plastic viscosity—yield value correlation for various mud systems.

ACKNOWLEDGMENT

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The authors wish to express their appreciations to Magnolia Petroleum Company for permission to publish this paper. Acknowledgment is also made for the cooperation of J. G. Savins and G. A. Spencer, who did much of the experimental work.

REFERENCES

[1] Beck, R. W., Nuss, W. F., and Dunn, T. H.: API *Drill. and Prod. Prac.* 1947 (1948), 9-22.

[2] Rogers, W. F.: *Composition and Properties of Oil Well Drilling Fluids* (1948), 213-232.

[3] Reiner, M., and Riwlin, R.: *Kolloid Z.* (1927), 43, 1-5; Reiner, M.: *Deformation and Flow* (1949), 43-46.

[4] Caldwell, D. H., and Babbitt, H. E.: *Ind. Eng. Chem.* (1941), 33, 249-256.

[5] Garrison, A. D., and ten Brink, K. C.: *Trans. AIME* (1940), 136, 175-194.

[6] Green, H.: *Industrial Rheology and Rheological Structures* (1949), 45-72.

[7] Cardwell, W. T., Jr., API *Drill. and Prod. Prac.* 1941 (1942), 104-112.

[8] Bednarski, V. N.: *Pet. Eng.* (1948), 20, 192-204.

[9] Eirich, F., and Riseman, J.: *J. Polymer Sci.* (1949), 4, 417-434.

[10] van Olphen, H.: *J. Inst. Petr.* (1950), 36, 223-234.

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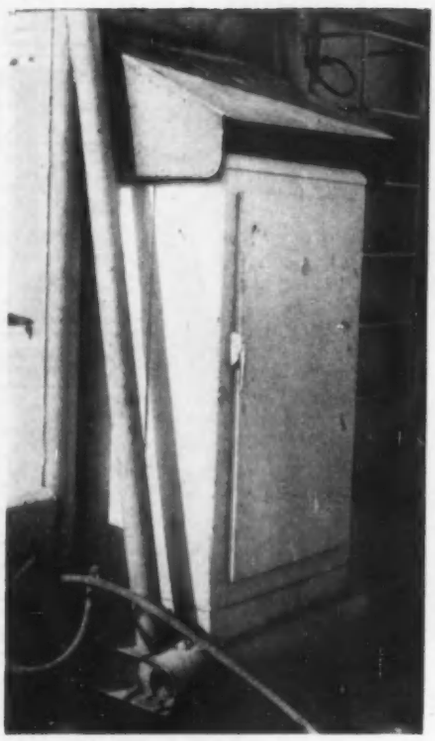
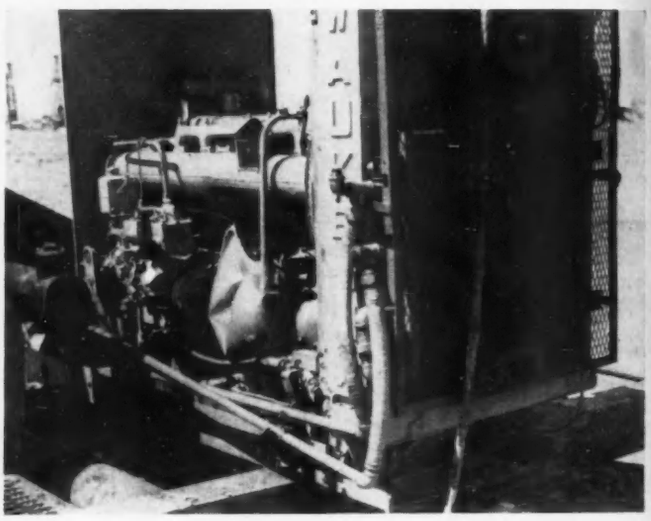


Rig Food Storage Problem Is Solved

Because of extremely high temperatures during the summer, storing food posed a problem for the men on the daylight tour. Investigation indicated that a space at the end of the generator building, which is also the support for a large diesel fuel tank, could be worked over as an ideal space to install an electric refrigerator.

The skid base of the structure extended forward a little farther than the depth of the refrigerator, so, a flat plate foundation was attached to the tow-bar and the side sill. A lean-to rainshield attached to the structure with side panels provided space for the installation. A conventional refrigerator set into this recess was connected to the rig electric current and the men were provided with a space for storage of perishable foods.

Radiator Cools Torque Fluid



A contractor installed an effective torque converter oil cooler by attaching an auxiliary radiator in front of the jacket water radiator of the mud pump engine. These oil cooling sections were put at the base of the water cooling radiator so the fan would draw sufficient air through both units to cool the torque converter oil without interfering with the temperature of the jacket water.

Pipe and flexible hose convey the oil from the converter to the cooler and return it to the unit for continuous circulation.

The hookup is such that no connections are broken when the engine and transmission are moved and cooling is begun immediately when the engine is started. As protection for the oil coolers, a heavy grille is bolted over the entire face of the radiator outside all the effective cooling surfaces.

Extension Speeds Handling of Pipe

There is no need for the truck swamper to use short pieces of pipe for bridging from the truck to the pipe rack when a telescoping bridge is permanently connected to the pipe rack. The slide extension consists of a pipe nipple with an outside diameter slightly smaller than the inside diameter of the pipe rack top rail. It can be any length desired, limited only to the over-all length of the pipe rack top rail.

For added convenience, a circular plate is welded to the outer end of the extension pipe to prevent its being pushed too far into the top rail. The circular plate also serves as a base for welding a hand hold bail so the extension can be pulled to the side of the truck without using a crowbar or heavy screw driver to dislodge it.

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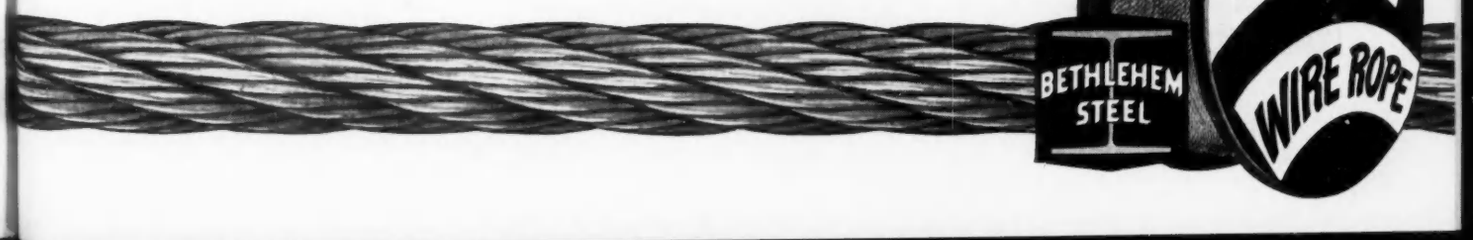

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(Spraberry) or
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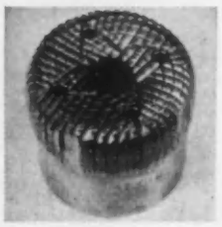
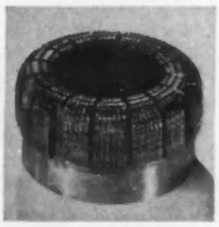


W.G.
General Purpose

W.H.
Chert or
Quartzite



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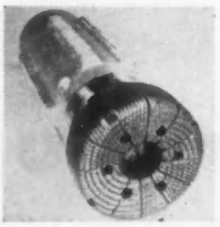

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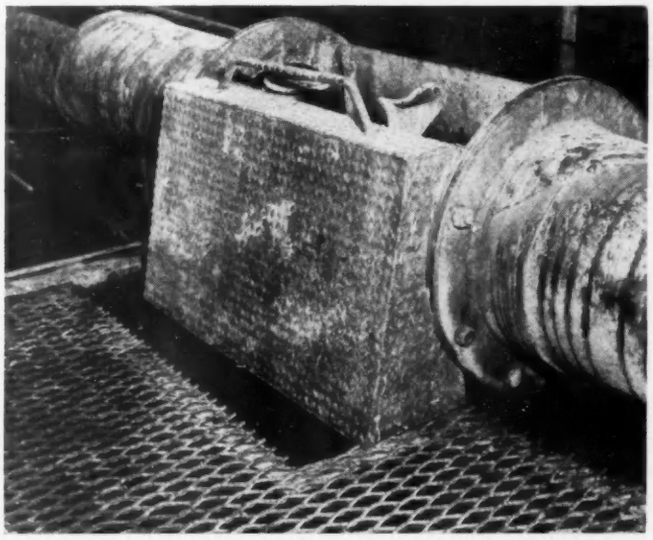
Pin Feature Aligns Pipe Rack

Perforating and pin locking pipe rack legs allows greater flexibility in plumbing the supporting runner. Often, the contractor is faced with the problem of installing pipe racks on sloping ground. To compensate for this condition, it is often necessary to requisition bulldozer services to provide a level spot for the racks. By rigging the rack with adjustable legs, this problem, to a certain degree, will be overcome.

Inspection of the accompanying photograph will show that the adjustable pipe rack legs are fabricated with short tubular goods segments. The base is made with a split section of six-inch pipe cut to a length assuring stability when the leg is in a vertical position. Next, a section of larger O. D. pipe is cut to conform with the rounded surface of the supporting base. After welding the vertical leg to the base, holes are burned through the leg to fit one-inch bolts.

The upper supporting leg segment is formed with pipe of a diameter smaller than the section welded to the base. In this manner, a telescoping unit is fabricated. Again holes are perforated through the upper leg segment and another split pipe is welded atop this same section. Remaining rack parts consist of full length joints which support pipe resting on the rack.

Metal Splash Guard Routes Mud to Shale Pit



A plate metal splash guard will divert mud to the shale pit and, at the same time, prevent mud from slopping over the tank walkway.

The mud system considered is rigged with three tanks. The shale and intermediate tank are in line while the suction pit is positioned at a 90-degree angle from the far end of the intermediate pit. With this plan in force, some arrangement must be made to either feed mud to the shale pit or, in some instances, bypass mud from the shale pit. For this circulating program, the illustrated splash tray serves a valuable service.

The flow line system, formed with sections of spiral casing, extend across the top of the shale and intermediate tanks. The illustrated bypass or feed device is stationed at the shaker end of the shale pit. At this point the flow line is gapped and metal flange rings are welded to either end of the system. The illustrated side is rigged with the welded plate metal splash box while the remaining side and bottom are fitted with flat plate sections. Holes are drilled in the ring flange to permit securing the splash box, side and bottom in place. Rubber gasket material eliminates possible leakage at the seam of each section.

Plate steel gates are stationed within metal bar guides located across the splash box exit and the flow line routed to the intermediate tank.

For rig transport, the splash box, side and bottom are removed, thus severing the flow line system into short lengths which are easy to handle.

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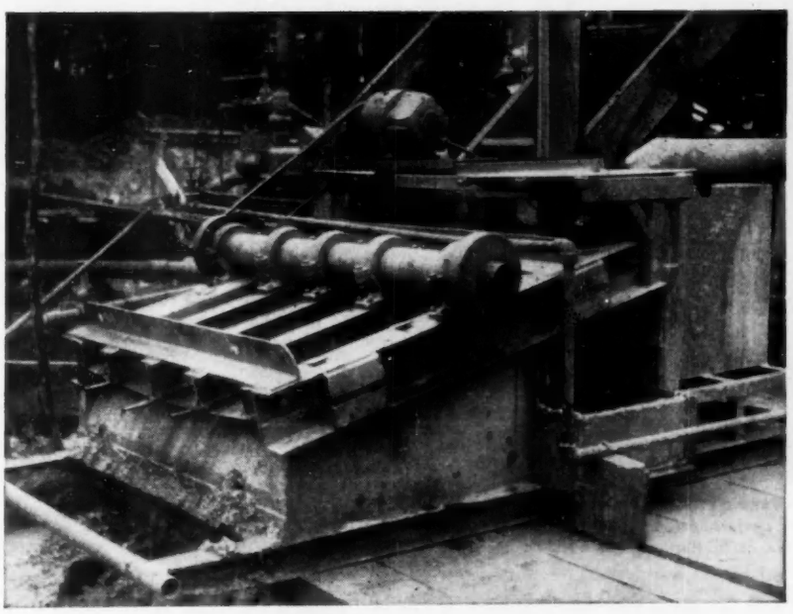

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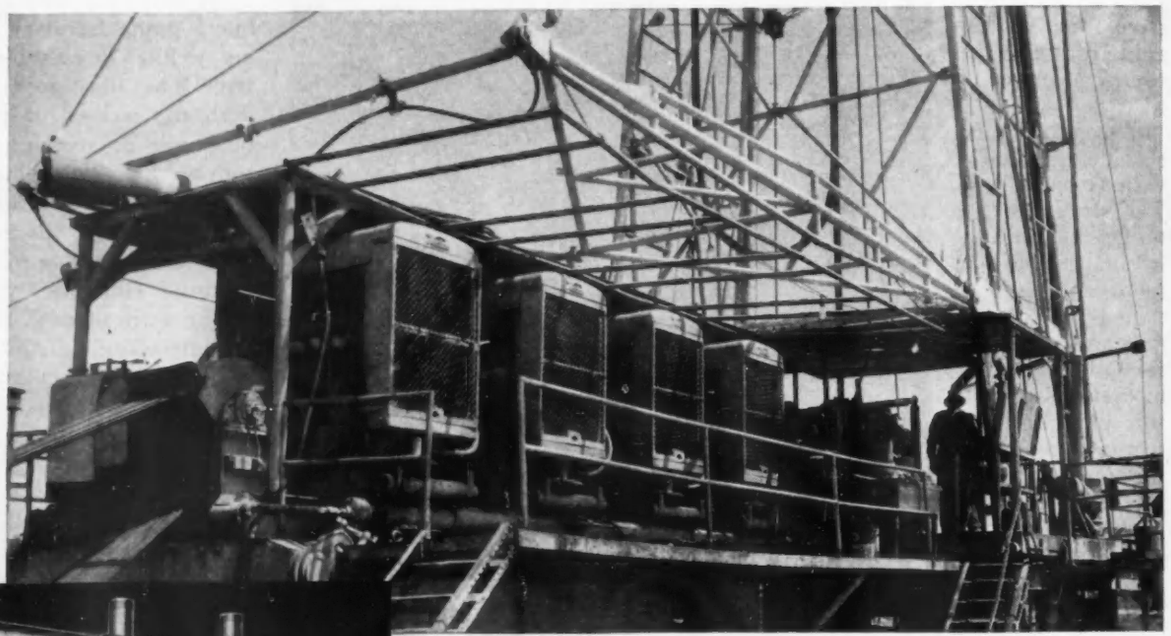

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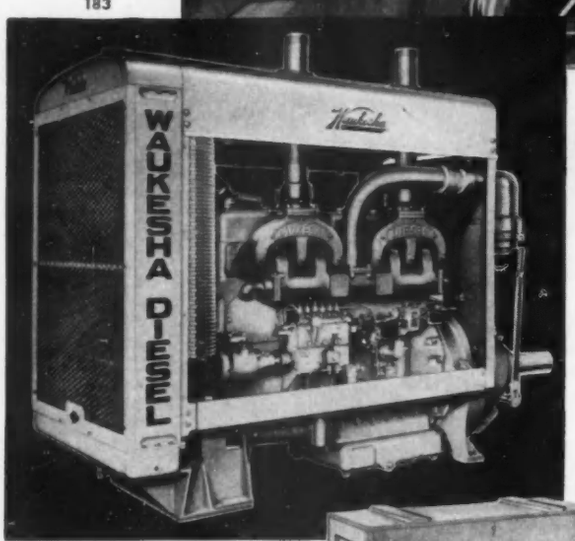

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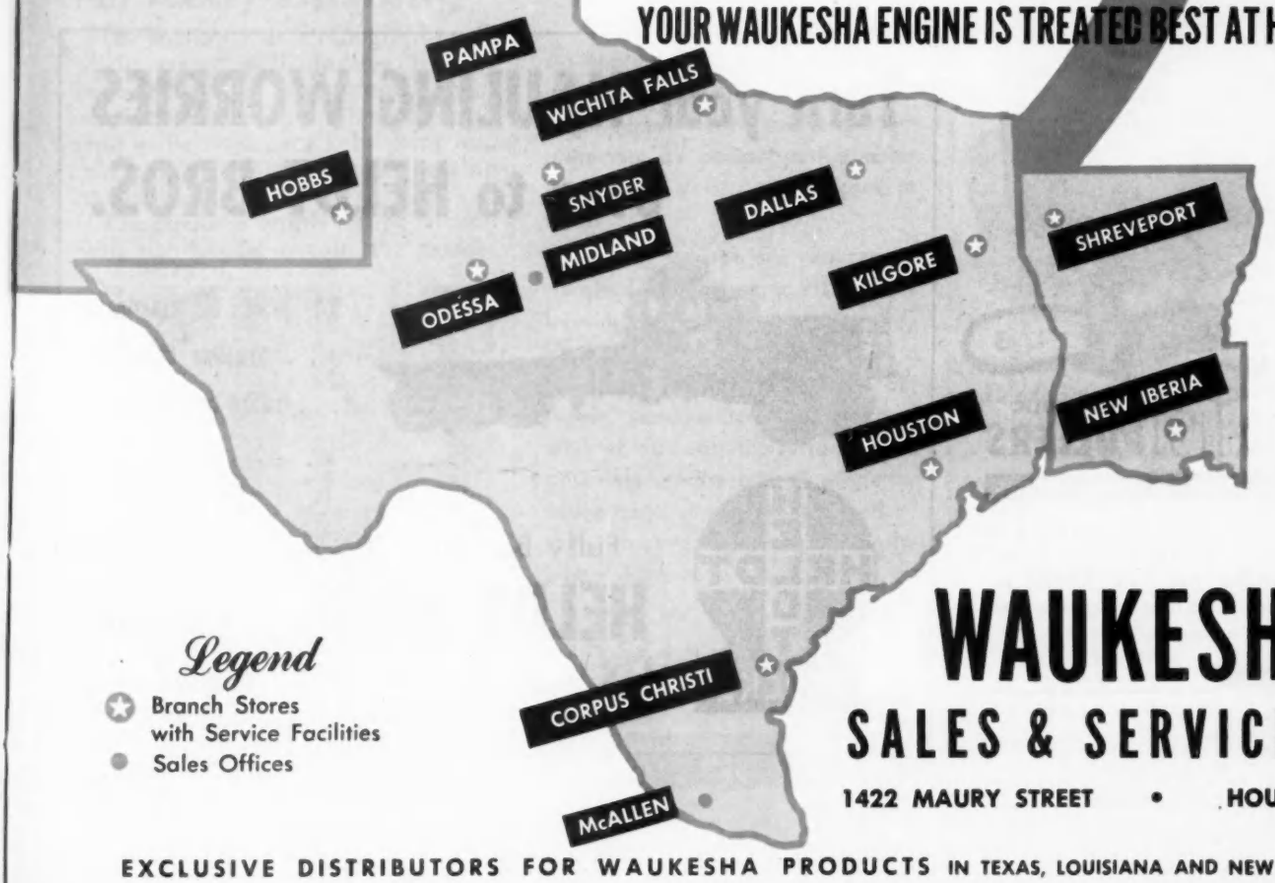

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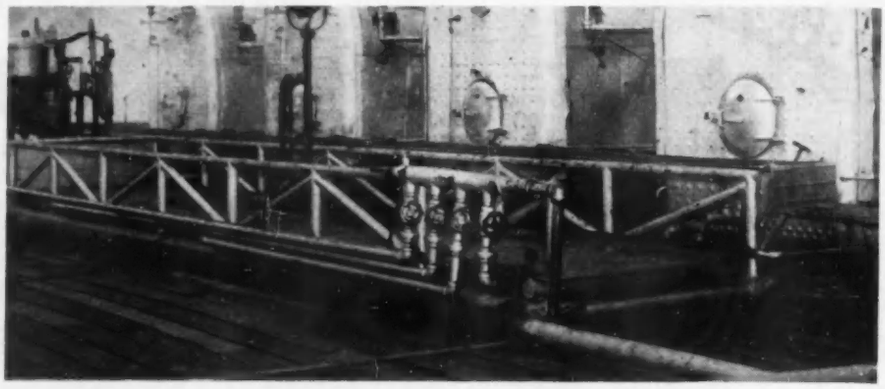

Rack Serves as Manifold

Boiler rigup operations can be expedited and an additional junk box made available by the construction of a combination manifold and rack structure. Formed with multi-size pipe sections, this combination equipment permits control valve unitization for the steam, water, air and fuel system, plus adequate volume chambers for fuel storage. One permanent floodlight support rests in the center of the boiler side rail to provide emergency lighting facilities.

Initial construction includes cutting the two, six-inch runners a length comparable to the distance occupied by the steam generating system. Angle formed on each end, the runners are anchored together with eight three-inch pipe sections. If the runners are to be used as volume tanks, the three-inch divider ends should be sealed to eliminate fuel communication between runners. In some instances, however, this feature may be desirable.

Additional support is supplied by nine four-inch pipe sections welded atop the runners. Aside from affording added reinforcement, these top dividers also locate the junk box floor a distance above the runner tops. This provision is made to permit running lines between the runners and the junk box floor.

Five-inch pipe verticals anchor the four-inch rail system on either side of the unit. Diagonal bracing provides a rugged construction feature so important on rig moves. It will be noted that the top runner, away from the fire boxes, serves as a steam car-

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rier. Having one end swaged for manifold valve placement, four valves are clustered at the boiler feed unit end for operating convenience. Each outlet connection is welded to the swaged rail section and hammer unions rest immediately below each valve.

The structure fire box side is rigged with four fuel outlets facing each boiler center. Either pipe connections or high-pressure hose lengths can be used for feeding fuel from the combination runner-volume drum to the boiler burners.

Further unitization is accomplished by anchoring an air compressor to the far end of the rack. Again, either the rail or runner system can be used to route and store compressed air.

Additional utility can be seen in the unit when it is necessary to move the rig. The junk box will house all connections which must be removed from the steam generating system. In this manner, rigging on a new location will become relatively simple for the firemen since, aside from the boilers, all other components are carried and stored in the combination rack. Although the initial unit cost may seem high, rapid amortization will be realized through more rapid rigup procedure.

Pipe Wrench Used As Kelly Bushing

For shallow hole seismograph work or in water well drilling, a kelly bushing may be made from a snap-on pipe wrench. This allows the drill pipe to be used as a kelly joint and much time can be saved in making connections.

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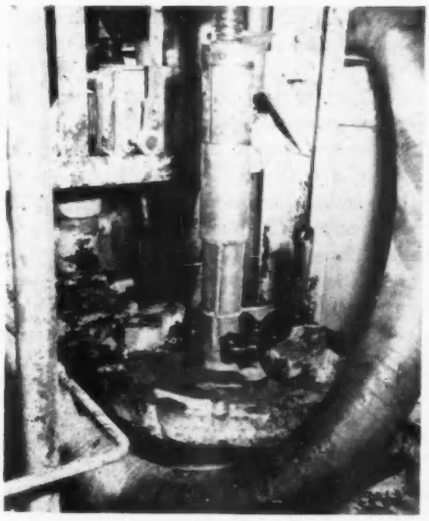

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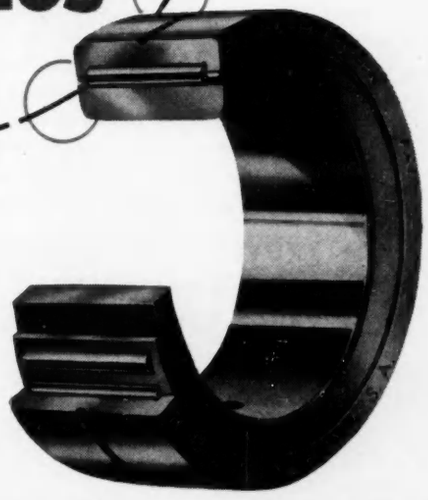

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and part of the end welded upright to a stub. Fitted on the rotary table and snapped onto the pipe, the device is applicable only with rotary tables mounted on hydraulic rams, such as those used in shot-hole drilling. As soon as the bit is on bottom, the rotary table is raised and the wrench snapped on and left until the length of the rams is used up. The wrench is then easily loosened, the rotary table raised and the wrench tightened on the pipe again.

Pedal Operates Cathead Lever

When tripping a rig or making a connection, the driller is often faced with a situation of having to handle several controls at the same time. Again, the normal position of the cathead control lever is above the driller's head and, in some instances, it might be rather clumsy to manipulate. With the possibility of one or more of these conditions existing, one operator rigged a simple pedal extension from the cathead control lever to the floor. With this equipment, the driller can operate the hand and foot lever together or independently.

Installation requires purchase of two small bearing journals complete with lubricating facilities. These bearing journals are bolted to the floor immediately under the hand lever. Then, a section of one-inch rod is formed in an "L" shape with a flat metal pedal on one end and a strap metal extension connecting the ¼-inch control rod.

A reamed, ¼-inch hole is made in the cathead control lever to accommodate the extension rod which is pean retained to the strap iron lever. The lower extension rod is formed at a 90-degree angle and perforated to house a cotter key. It will be noticed that several holes have been drilled in the floor pedal arm. With this facility plus the turnbuckle system, adjusting the foot pedal angle presents no problem.

A heavy-duty spring is anchored atop the foot pedal and extends to a metal loop welded to either the brake piping system or the drawworks case. This spring jerks the foot pedal to an operating position after it has been depressed.

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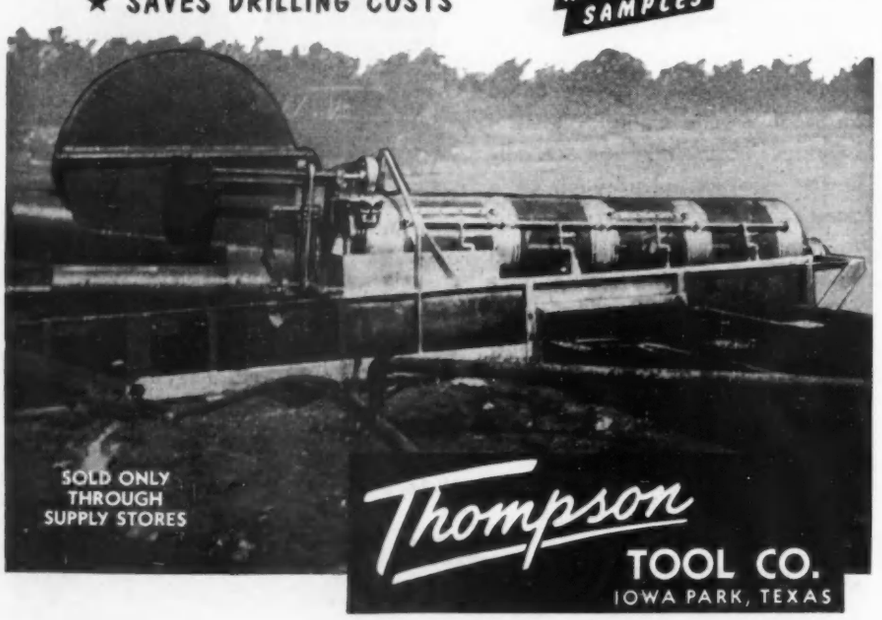

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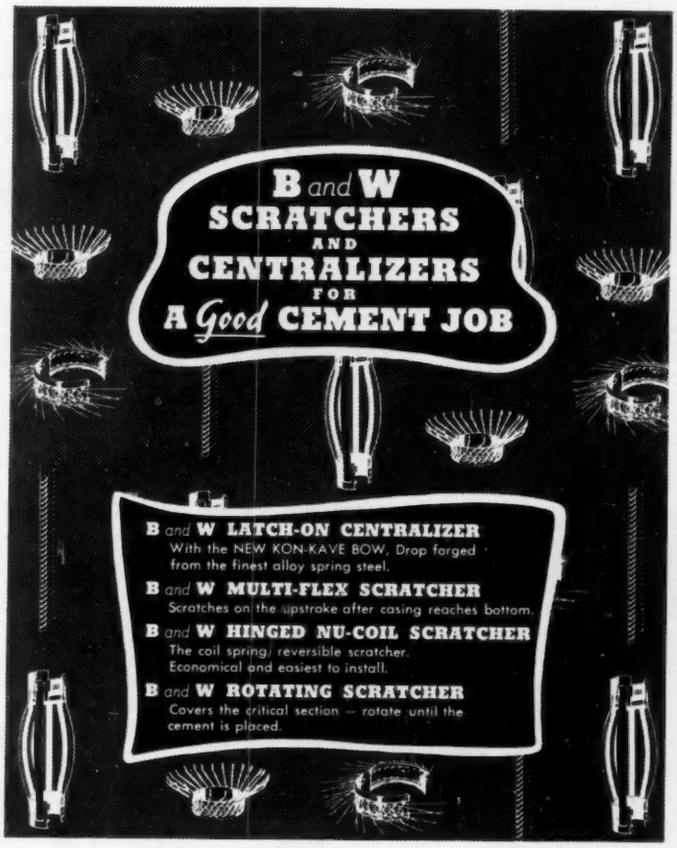
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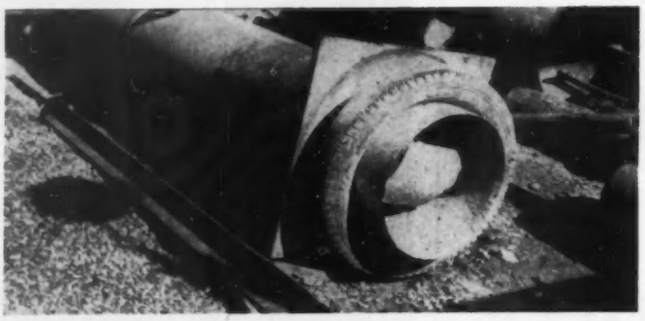
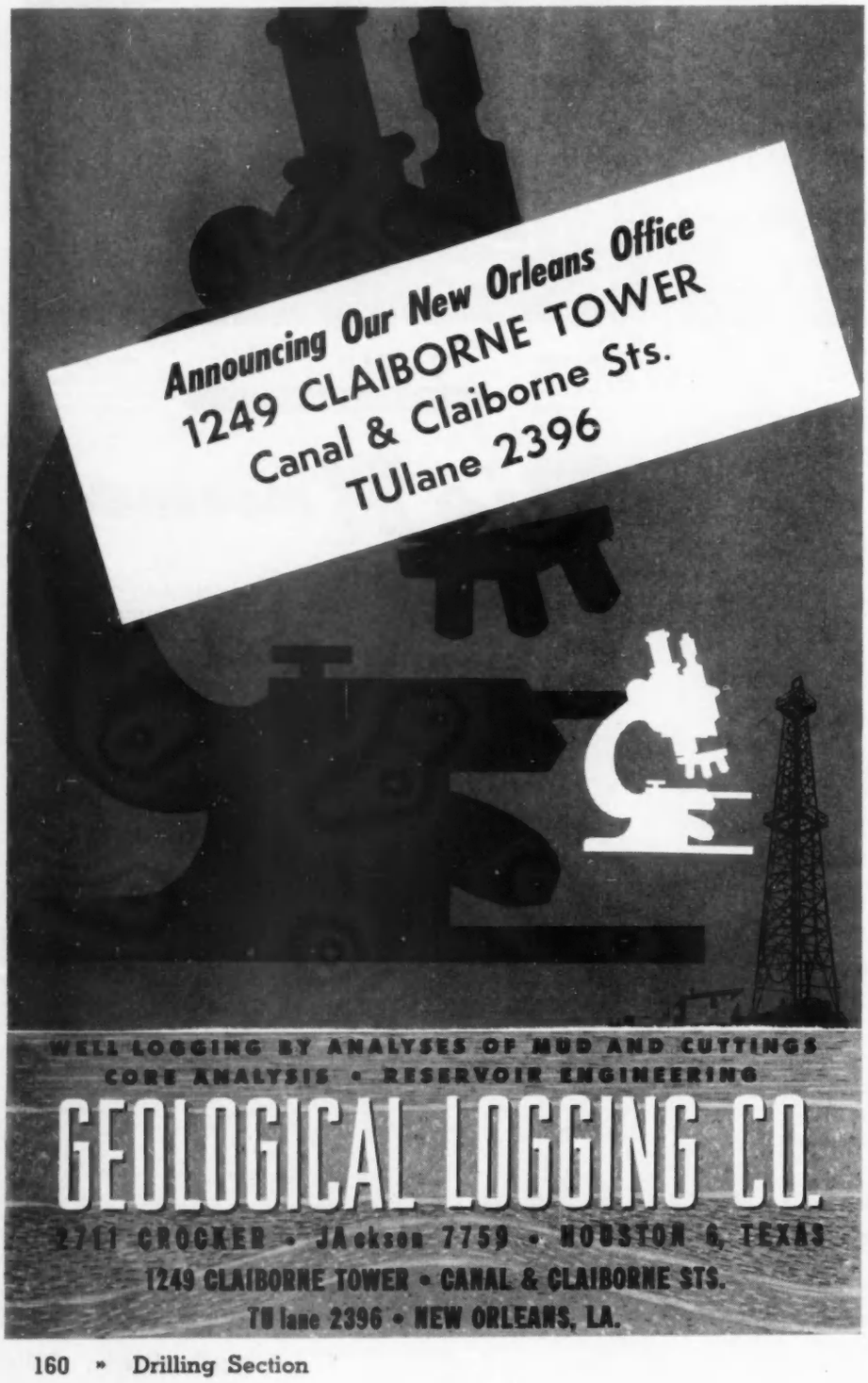
Low pressure or top hole drilling operations will find definite advantage in the illustrated flow pipe, fitted with an automobile tire gasket, which need not be welded to the conductor string. Especially designed for quick rig-up practice, the prefabricated flow pipe is complete with a flow line connection and line snubbing eyes. A three-eighth inch steel plate retainer, center cut to fit the outside diameter of the pipe, is welded in place approximately 18 inches above the joint base.



The conductor pipe, which is of larger o.d., is fitted with a similar retainer plate tack welded in place. By dropping the flow pipe over the conductor pipe and tightening the four wire rope guy lines, the operator has a simple, leak-proof casing extension.

Fabricated at low cost, this unit will soon pay for itself in time saved during the rig-up period.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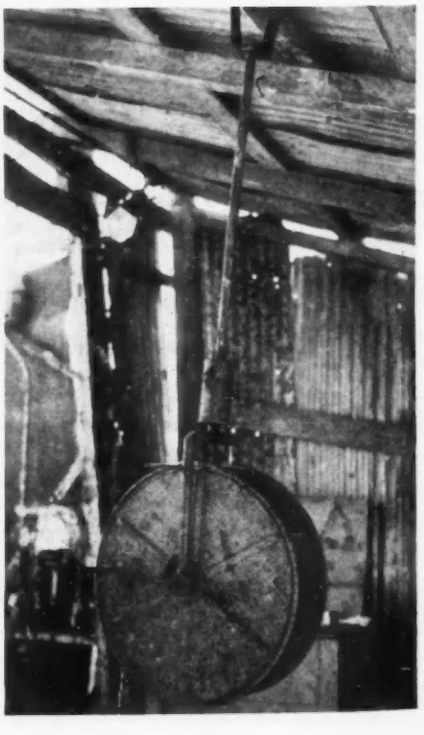
Catline Protected By Rotating Spool

The illustrated catline spooling device is mounted with a hanger attached to a rafter of the engine room or drawworks shed. The supporting section of the hanger is one-inch rod with a clevis at the upper end containing a pin which is slipped through the top holes in the clevis when raised above the rafter or portion of the shed where the spool is to be stationed.

The drag line is spooled neatly on the reel and accidental unspooling is eliminated by locking pins inserted through the yoke and matching holes drilled around the rim of the spool ends.



High Pressure Gas Injected in Block 31

Experiments Indicate Material Increase in Oil Recovery From Devonian Reservoir in Crane County, Texas

By

B. L. GRIFFITH and V. M. HOLLRAH

The Atlantic Refining Company, Dallas

A MATERIAL increase in oil recovery has been indicated by laboratory experiments as a result of high-pressure gas injection into the Devonian reservoir of the Block 31 field in Crane County, Texas. Gas produced from the Devonian and Ellenburger reservoirs in the field is being gathered and reinjected into the reservoir at a well head pressure of 4000 pounds per square inch. This program was instituted less than four years after the discovery of the field, and while the reservoir was being defined and developed.

During the three years that the project has been in operation, the system of injection wells has been enlarged from two wells in the crest of the structure to five wells. Further enlargement and modification of this system are contemplated to a total of 13 injection wells, which will be dispersed throughout the field to produce a nine-spot injection pattern.

In order to maintain a reservoir pressure of 3500 pounds, it is planned to supplement the present gas injection with a sufficient volume of outside gas to equal the reservoir voidage. This program will permit a field evaluation of the increase in ultimate recovery resulting from injection of high-pressure gas into an under saturated oil reservoir.

Unitization. Shortly after the discovery of the Block 31 Devonian Reservoir, it was evident that some form of pressure maintenance should be considered because of the expected drive mechanism and relatively low well productivity. With this objective, negotiations were started to unitize the field while confirming reservoir data were accumulated. On Jan. 1, 1948, approximately two years after the first well was drilled, four operators, Champlin Refining Company, Continental Oil Company, Phillips Petroleum Company, and The Atlantic Refining Company, combined their operating interests to form the Block 31 Joint Operations. This was possible because the entire producing acreage of the field is owned by The University of Texas Lands. The original Joint Operation consisted of 4160 acres developed essentially on a 160-acre pattern with 26 Devonian wells of which 11 were dually completed with the Ellenburger. Atlantic, as operator of the unit, proceeding with the design and installation of compressor facilities, gathering lines and injection system which would utilize all gas produced from the Devonian and Ellenburger formations in the field. In January 1950 the first addition of 1120 acres was made to the original Joint Operations and a second addition of 960 acres and full unitization of the field is being negotiated at present.

The Block 31 Devonian Field now covers an area of some 6000-7000 productive acres and is essentially developed with the present 68 completed wells. There are two developed 160-acre tracts in the field outside the unit area which are not

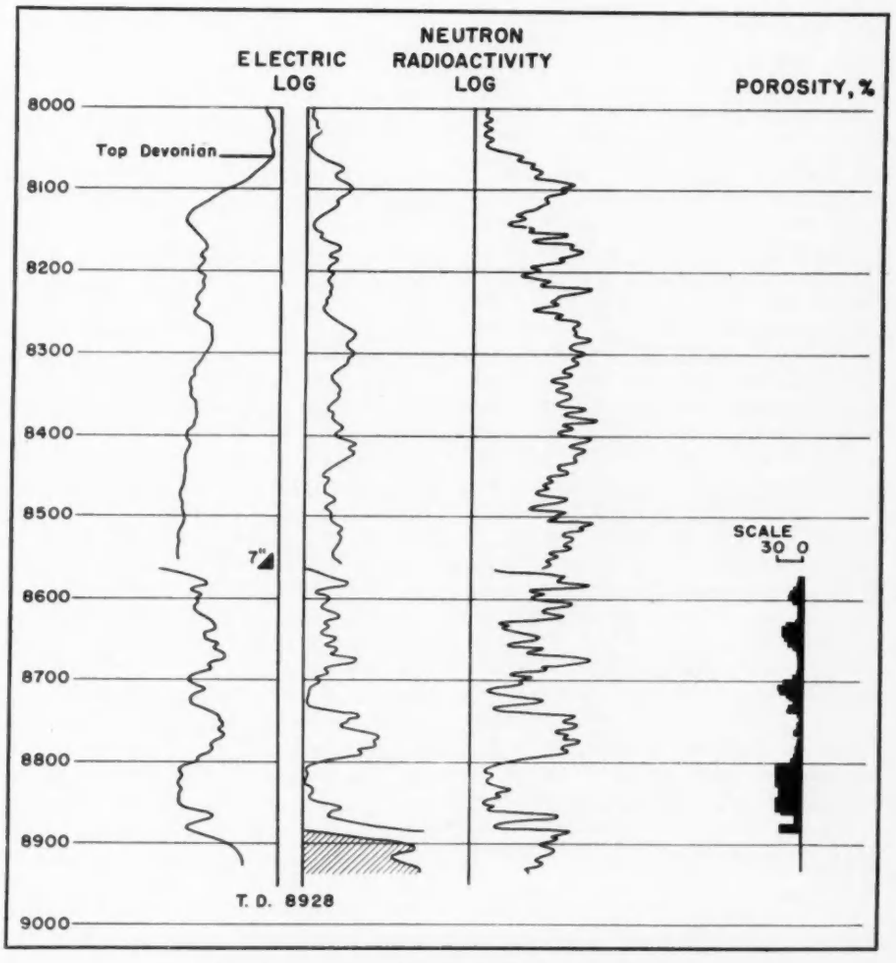


FIGURE 1. Type log, Devonian section, Block 31 field.

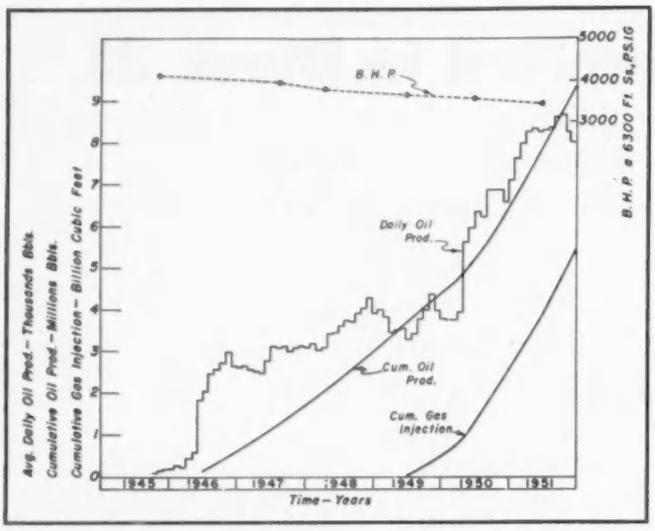


FIGURE 2 (above). Past reservoir performance. Block 31, Devonian field, Crane County, Texas.

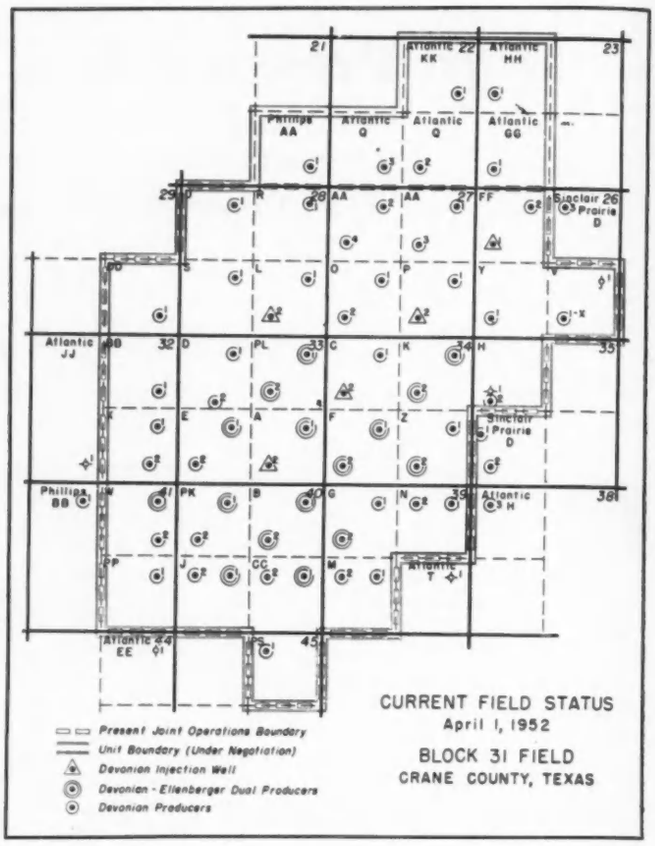


FIGURE 3.

participating in the pressure maintenance program.

Reservoir Rock and Fluid Characteristics. The Devonian formation in this field is encountered on the crest of an anticlinal structure at a dep of 7900 feet and has a gross thickness of 1000 feet. The main oil producing section is in the interval from 450-800 feet below the top of the Devonian. This 350-foot interval contains some 85 percent of the oil-in-place and is the only portion of the reservoir which is considered for gas injection at present. Up to 185 feet of this section is net pay in some of the higher structural wells.

The reservoir rock appears to be a limey and dolomitic sand with intergranular porosity ranging up to 28 percent and averaging 15 percent over the net pay section. Some small fractures were noted in cores but these are not believed important and may have occurred during or after coring. From the three cores taken in the Devonian pay section, it was possible to obtain a good correlation with electric and radioactivity logs with which the entire reservoir could be analyzed. Figure 1 shows a typical log of the Devonian with corresponding porosity from core analysis through the main pay section. Although the porosity averages 15 percent through the pay section, the permeabilities are extremely low. Effective permeability calculated from reservoir pressure build-up analyses[1] range from .1 to 3 millidarcys with an average of 1.0 millidarcy. Air permeabilities from core analyses are somewhat higher with a weighted average of 2.7 millidarcys.

An average interstitial water of 37 percent was determined for the reservoir by subjecting plugs to high speed centrifuging and correlating the results with permeability and capillary pressure curves. There has been no evidence of any gas cap in the formation.

Analysis of the crude shows the oil to have 1212 cubic feet of gas per barrel in solution at saturation pressure of 2764 pounds. Gravity is 46° API and viscosity at saturation pressure is 0.3 centipoise. It should be noted that the saturation pressure is almost 1400 pounds below the initial reservoir pressure.

Past Reservoir Performance. During the 3½ years prior to starting gas injection, 3,700,000 barrels of oil were produced with a decline in reservoir pressure from an initial of 4145 pounds to 3650 pounds, as shown in Figure 2. The determination of actual reservoir pressure was complicated by the low permeability and slow pressure buildup. Extensive pressure surveys were taken annually and a method[1] was developed for calculating final reservoir pressure from buildup curves. Accuracy of the calculated final pressures was confirmed to some degree when pressures taken on completion of infill wells checked closely with the calculated pressures for that portion of the field. It also indicated that the initial development on a 160-acre well pattern was draining the reservoir even with the low permeabilities.

In June, 1949, gas injection was begun in the Joint Operation C-2 well located near the center of the field. This well, which had been completed several months earlier, had been used as a producing well until injection started. Productivity and buildup data accumulated during this period were used in predicting injectivity of later wells converted to injection. With the well-head injection pressure of 4100 pounds, 3½ million cubic feet of gas were injected daily. This well has been on injection almost continuously to the present time with no appreciable change noted in its injectivity. In November 1949 injection was started on the P-2 well two locations to the northwest of the initial injection well. The injectivity and performance of this well were similar to the Joint Operation C-2 well.

Bottom-hole pressure tests were taken at 8800 feet, opposite the formation face, on these two wells while gas injection was taking place at a well-head pressure of 4100 pounds. The flowing injection pressure recorded at the bottom of the hole for 14 hours was approximately 5130 pounds. After the wells were shut in the pressure dropped almost immediately to 4900 pounds and at the end of 28 hours the pressure was 4750 pounds and declining at only three pounds per hour. At the time these tests were taken, the average reser-

voir pressure was approximately 3600 pounds. This indicates that the injection-gas zone is at a considerably higher pressure than the reservoir's average, and substantiates calculations.

Two wells were put on injection during 1951 and one well in April, 1952, to meet increasing injection requirements and to permit a more dispersed pattern of injection throughout the reservoir. Figure 3 is a map of the field showing wells currently on injection as well as the proposed unit outline and well completions.

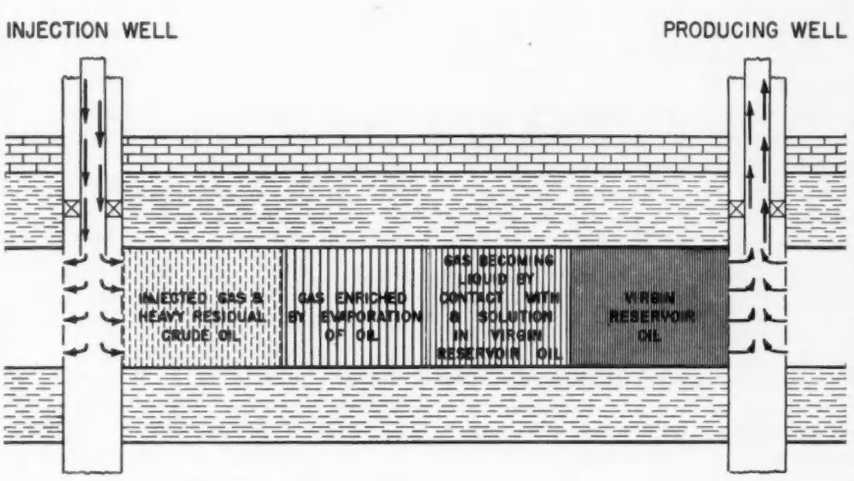
From June, 1949, to July, 1951, 4,100,000 barrels of oil were produced with a drop in reservoir pressure from 3650 pounds to 3450 pounds. During this same period 3,797,334 thousand cubic feet of gas was injected into the reservoir having an equivalent volume under reservoir having an equivalent volume under reservoir conditions of 2,548,000 barrels. Although it is too early to state conclusively, it appears that a limited water influx is occurring in the reservoir which amounts to an estimated 3000 barrels per day.

To date there has been no indication that the Devonian reservoir has been affected by the injected gas other than the retarded pressure drop. During the June, 1951, pressure survey, producing wells offsetting the injection wells showed generally a smaller decline in pressure relative to other producing wells in the field. In one instance the pressure actually had increased slightly over the previous survey. No increasing ratios or other signs of gas breakthrough have occurred after nearly three years of injection, but this is significant only to the extent of eliminating the possibility of channeling through the fracture system as calculations show that injection should be continued for several more years before breakthrough occurs.

During March of 1952, daily production from the reservoir was 8370 barrels of oil, 36 barrels of water and an average of 10,380 MCF of gas. This amounts to a reservoir voidage of 14,100 barrels per day as compared to an average of 8733 MCF (reservoir equivalent 5860 barrels) per day of gas injected.

Pressure Maintenance. The original plan for pressure maintenance was to inject all gas produced from the Devonian and Ellenburger formations into a portion of the Devonian reservoir with the objective of increasing the ultimate oil recovery and maintaining the productivity of producing wells.

A sufficient number of injection wells were to be utilized on the crest of the structure to handle the volume of gas available and the compressor plant was based on expected capacity requirements some two years in the future considering probable continued development. Additions to these facilities were to be made as required.


INJECTION WELL
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GAS ENRICHED BY EVAPORATION OF OIL
GAS BECOMING LIQUID BY CONTACT WITH & SOLUTION IN VIRGIN RESERVOIR OIL
VIRGIN RESERVOIR OIL

FIGURE 4. Process of recovering oil by high-pressure gas injection.

Initially three 800 horsepower compressors were installed. Two of these were designed with intake pressure of 7 pounds and the third with 120 pounds. The combined discharge capacity of the three compressors was approximately 7 million cubic feet per day at 4100 pounds. Increasing field gas production necessitated additional compressor capacity and in May, 1951, a fourth compressor, 880 horsepower, was added which increased the delivery capacity to 9 million cubic feet per day at 4100 pounds. The intake pressure on this fourth compressor is also 7 pounds. Incidental to compression and cooling of the gas, approximately 16,000 gallons per day of liquid products are recovered and stabilized. All of the gas produced in the field by the Joint Operators is processed through the plant. A portion of the gas is sweetened and used for plant and lease operations.

Two Gathering Systems

Two gathering systems were installed in the field. The first, a high-pressure system, is connected to the separators of wells capable of flowing against a 125 pound separator pressure; the other, a low-pressure system, takes the remainder of the gas in the field from wells unable to produce against the higher pressure. Both systems are of sufficient capacity to take care of anticipated future needs.

The first two wells put on injection were initially completed in anticipation of using them as injection wells. Casing was set to total depth and all of the main producing section in which gas was to be injected was perforated. Gas was injected through 2½-inch N-80 tubing using a packer to load the annulus with oil and keep the pressure off the casing. Considerable difficulty was experienced with leaks occurring generally at the collars which allowed the casing annulus to pressure up. In order to overcome this difficulty, N-80 tubing with special joints was run in later injection wells, and the casing was loaded with salt water base mud to reduce the differential pressures across the tubing. The well-head equipment consists of a scrubber, recording orifice meter, and a 10,000-pound test christmas tree.

In the higher structural portion of the field nearly all wells were dually completed. In these dual completions the Devonian formation is producing at a depth of 8500-9000 feet through the casing and the Ellenburger is producing below 10,250 feet through the tubing. The third well put on injection, the Joint Operation A-2 well, was such a dually completed well. An attempt was made to inject gas through the tubing using two packers and a crossover arrangement so the Ellenburger could be produced through the annulus. This method was unsuccessful because of mechanicial difficulties, so the Ellenburger formation was temporarily plugged off and the allowable transferred to other Ellenburger wells in the field. When

steel supplies permit, the plug will be drilled and a liner of 5½-inch special jointed heavy casing will be set in the well. This will permit gas to be injected into the casing annulus and Ellenburger production to be resumed through the tubing in much the same manner as present dually completed wells are being produced.

In converting Devonian producing wells to injection wells the procedure followed was to perforate or open the entire main pay section. On flank wells this may involve deepening and injecting below the water-oil contact so that the up-structure oil in the zone can be swept. Permanent type packer on 2½-inch tubing with special joints were run and the annulus loaded with mud.

Laboratory Experimentation

Laboratory work performed by The Atlantic Refining Company concerning high-pressure gas injection will be covered only briefly here as it has already been published in a paper by Whorton and Kieschnick.[2] The Block 31 Devonian crude oil and reservoir were studied for application of this high-pressure gas process and found favorable.

Laboratory evaluation was performed using equipment constructed to simulate the flowing and displacement process that occurs in the reservoir. The main feature of this equipment was a 25-foot, high-pressure vessel, packed with unconsolidated sand which could be maintained at the reservoir temperature. Devonian crude, at reservoir saturation pressure of 2760 pounds, was pumped through the sand column until it was fully saturated. Lean tail gas, similar to that which would be obtained from a gas transmission line, was then pumped into the column displacing the oil at a pressure of 3500 pounds. The fluid withdrawals from the column were measured, sampled and analyzed. The results of several runs, as described above, indicated that approximately 76 percent of the charged oil can be recovered by the high-pressure gas process. Obviously, the relative permeability characteristics of this test column are different from those found in Block 31 Devonian rock. A correction factor was applied, taking this into consideration, so that the result estimated in Block 31 is 69 percent rather than the 76 percent measured.

To illustrate briefly what is believed to occur in the reservoir when high-pressure gas is displacing reservoir oil, reference is made to Figure 4. This is a schematic drawing of the reservoir, between a producing well and an injection well, divided into four segments.

The segment on the right contains the virgin reservoir oil moving into the producing well. On the left the reservoir contains a dry gas moving out from the injection well and a heavy residual oil. Between these are the two inter-related segments in which the high-pressure gas process occurs. The segment immediately behind the virgin reservoir oil contains a transition zone in which an enriched gas grades into a liquid. Gas, before entering this zone, has become enriched through contact with residual oil in passage through the reservoir and has by virtue of this enrichment achieved a high degree of solubility in the virgin oil. This source of enriched gas contacting virgin reservoir oil creates a bank of swollen liquid which is light in gravity and approaches the viscosity of the virgin reservoir oil.

The next segment of the reservoir is in the oncoming gas, enriched by evaporation of residual oil. As the swollen liquid bank of the transition zone displaces the virgin oil ahead, the residual product remaining is a swollen oil characterized by a high formation volume factor in the range of 3 to 5 reservoir barrels per stock tank barrel. As oncoming gas moves across this swollen product, evaporation of the lighter hydrocarbons occurs, enriching the gas. This enriched gas then repeats the same cycle of contacting and going into solution with the virgin oil.

The net result of this continued cycling process is that back of this transition and enriching region is a zone containing only dry oncoming gas and a heavy residual product estimated at 15 degree API gravity in the Block 31 reservoir.

Thus the increased recovery by high-pressure gas injection is gained principally by: (1) improved displacement efficiency resulting from decreased viscosity differentials between displacing and displaced fluids and (2) evaporation and solution effects which reduce the final residual oil saturations in the reservoir.

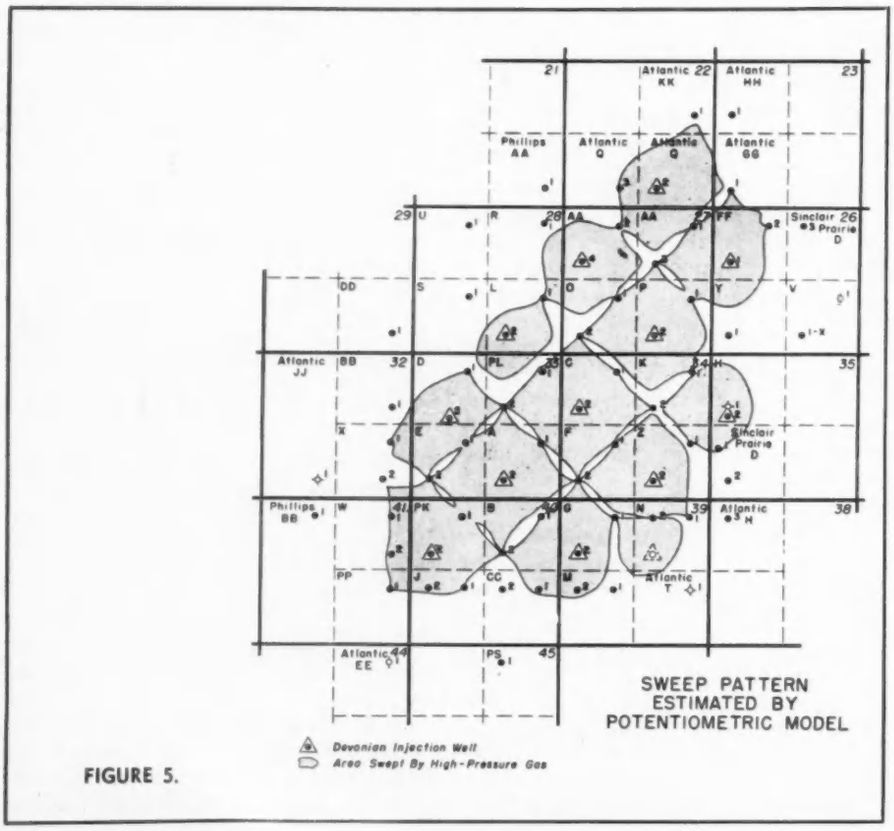

FIGURE 5.

Full-Pressure Maintenance

In February, 1951, the decision was reached to enlarge the scope of the Devonian gas injection project from partial pressure maintenance to a full-pressure maintenance program at 3500 pounds. By this change in operation it is anticipated that the ultimate recovery will be increased by 40 percent over the present partial maintenance program, or almost 70 percent over primary operations. Before undertaking full pressure maintenance operations, five major items must be accomplished: 1. Securing an adequate source of outside gas. 2. Unitization of the field in place of the existing Joint Operation. 3. Addition

WHY AXELSON SUCKER RODS ARE LEADERS IN THE FIELD

For 60 years Axelson has been producing equipment for the Petroleum Industry. Specialized knowledge of the field and in techniques of manufacture make Axelson products natural leaders. Sucker rods are a case in point. Here are 13 steps in manufacturing procedure which lead to Axelson sucker rod quality.

STRAIGHTENING A perfectly straight bar is paramount in the manufacture of sucker rods. The first operation is done in a Medart bar straightener, after which, careful checks are made for kinks or bends. Bars are then trimmed to exact length.

FORGING Due to length of stock gathered for the upset, in comparison to the diameter of the rod, the upsetting of sucker rod ends is a very difficult operation. Holding the upset to size and shape is only part of the requirement. Steel, after being rolled, has a grain similar to that of wood, and, like wood, its strength is much greater when the load is taken in a direction parallel with this grain. For this reason, it is necessary to upset the rods in such a manner that this grain will deviate from a straight line as little as possible. This requires understanding of forging practice that can only be acquired by years of experience, combined with the latest scientific knowledge. Forging must be done with correctly designed dies on steel that is exactly at the proper temperature. The design of the furnaces used to heat the rods for forging is the result of years of effort to produce perfect results. Maintaining the temperature of these furnaces is not left in the hands of the operator, but is controlled by an automatic recording pyrometer.

IDENTIFICATION MARKS After the last forging operation, code letters and trademarks are stamped on the flat of the wrench square. This identification is kept as a complete record in the laboratory files making it possible to determine the whole history of the rod.

DESIGN OF THE ROD END The finished upset consists of the pin end and its shoulder, both with stock left for machining, the square, which must be smooth and to size so as to fit standard wrenches, and the lower shoulder which is tapered into the body of the rod. In the design of Axelson rod forgings, the change in section is a taper in which the metal is so distributed that any bending stress which may occur because of hole crookedness will be spread over as great a length of rod as possible, thereby eliminating excess stress concentration.

HEAT TREATING In this operation, the rods are heat treated the *full length* to insure uniform grain structure from end to end, and the best combination of strength, ductility, and shock resistance.

DESCALING Any ferrous material, when heated to temperatures necessary to accomplish the purpose of normalizing becomes encased in a thin covering of iron oxide. The removal of this scale is done by passing the rods through a shot blast cleaning machine of the continuous type. Removal of the scale exposes any rolling or forging defects, and at this time another inspection is made for straightness.

THREADING The rods are now transferred to the Threading Department where a battery of ram-type turret lathes is used for the machining. This equipment permits better control and supervision by the operator over each individual rod, producing greater uniformity and accuracy.

FINAL INSPECTION As the rods are rolled out on steel trestles to facilitate gaging, they are again carefully scrutinized to detect and eliminate any rods having rolling or forging defects. The thread protectors are then removed, gaging is done in accordance with gaging practice recommended by the American Petroleum Institute. A rust preventing grease is then applied to the finished pin end.

ASSEMBLING COUPLINGS TO RODS The rods are now placed on an assembly table, on one end of which is solidly attached a square socket. The need of screwing up sucker rod couplings sufficiently tight against the shoulder cannot be too greatly emphasized. Unless the sucker rod pins are pre-loaded by this means, beyond any load that will ever be applied in service, there will be a reversal of stress because of pumping motion, and also, if there is any misalignment because of hole crookedness, a bending moment will be imposed at the bottom of the thread causing severe stress concentration because of the "mechanical notch" effect of the thread, and a fatigue fracture will prematurely develop.

PAINTING Painting of the rods is a protective measure. It is accomplished by dipping in red Vinyl paint and drying under heat lamps.

STORAGE OF FINISHED RODS In placing the finished rods in the storage piles, plenty of blocking is used between bundles to prevent bending and to allow the rods to lie straight. The same care is taken in shipment.

ADDITIONAL CHECK TESTS Although there is a laboratory control on every step in the manufacture of Axelson sucker rods, additional tests are made regularly on the finished product. Forged ends that have been rejected because of machining defects are cut off and sent into the laboratory for physical tests. Still other forging specimens are prepared and tested in the fatigue machine and in the Izod Impact Machine.

FATIGUE TESTS ON FINISHED RODS A final fatigue test on finished rods concludes the manufacturing process. Two 4′ sub rods are joined together with a coupling in the usual manner and placed in a machine which puts them in tension approximating the peak load encountered in well service. Bending, hammering, and severe vibration constitutes this very severe test and gives the equivalent of lifetime of service to the rod.

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to the compressor plant. 4. Obtainment of special field rules to allow efficient field operation. 5. Modification and enlargement of the gas injection system from two injection wells to thirteen.

At the present time it appears that the start of full-pressure maintenance will be delayed two to four months, principally because of the unavailability of certain kinds of pipe and equipment.

Unitization is virtually completed pending final approval by the Board for Lease of University Lands, General Land Office, and a hearing before the Railroad Commission.

Five additional 880-horsepower compressors are now being installed. These, together with the existing plant, make a total of nine compressors with 7680 horsepower. The capacity of this enlarged plant will be in excess of 30 million cubic feet of gas per day at a delivery pressure of 4100 pounds. Approximately 45 percent of this amount will be makeup gas purchased outside the field at 500-800 pounds pressure.

In August of 1951 a hearing was held before the Railroad Commission of Texas at which time application was made for: (1) permission to undertake full-pressure maintenance operations in the Devonian reservoir, (2) determination of a field MER under full-pressure maintenance operations, and (3) to exempt the field from shutdown days, such MER and exemption to be effective when the high-pressure gas injection system is in operation. The Railroad Commission was most cooperative in recognizing the special problems involved in undertaking this project and granted this application in full.

In regard to the MER, it was recognized that the complete program might not be put into operation at one time because of material shortages and the table shown below was adopted by the Commission as a basis for determining the field oil allowable. In this table, volumes shown in the "Gas Injection MCF" column were calculated as those necessary to replace reservoir voidage at 3500 pounds at corresponding rates of production shown in the "MER, Barrels Per Day" column:

Gas Injection MCF	MER, Barrels Per Day
28,200	13,500
26,000	12,300
24,000	11,500
22,000	10,700
20,000	9,900
18,000	9,100
16,000	8,300

About the Authors

Griffith

Hollrah

B. L. GRIFFITH received his B.S. degree in petroleum engineering from the University of Oklahoma, and in 1937 joined The Atlantic Refining Company. For four years he worked principally in West Texas. He served in the U. S. Army Air Force from 1941 to 1945. Upon his discharge, he joined Atlantic in 1945. He was made a senior petroleum engineer in 1950.

V. M. HOLLRAH joined the Petroleum Engineering Section of The Atlantic Refining Company at Dallas in July, 1949. Earlier that year, he was graduated from the University of Oklahoma with a B.S. degree in mechanical engineering. For the past 18 months he has been associated primarily with reservoir engineering studies of secondary recovery and pressure maintenance projects.

The reason it was necessary to obtain exemption from shutdown days was because of the complexity of the practical operation of such an interrelated injection and production system. To obtain maximum areal sweep efficiency it will be necessary to balance the rate of injection between the various injection wells and at the same time control the rate of oil withdrawal from producing wells. This situation is further complicated by the variations of the purchased gas supply. During periods in the winter, little or no gas may be available and this shortage must be made up during the summer months. Thus, it becomes essential that the oil producing rate be maintained on a stable basis to efficiently operate the field.

The initial plan for pressure maintenance in the Devonian reservoir was to inject all the produced gas from the field into two or more wells along the crest of the structure. As plans were formulated for full-pressure maintenance, it was determined that because of low permeabilities in the reservoir, pressures could not be maintained on the flanks by any type of line injection along the crest. Maintenance of a 3500 pound pressure at the oil-gas interface is essential to the successful operation of the high-pressure gas process. Consequently, a system of 13 injection wells dispersed over the field was decided upon, as shown in Figure 5. This system approximates a 9-spot pattern and is considered the optimum among the many combinations of injection and producing wells studied. In addition to permitting a good areal sweep, the pattern will maintain both a satisfactorily high pressure throughout the reservoir and a substantial rate of recovery with the drilling of a minimum number of additional wells. Expansion to this system is presently taking place as the necessary pipe and other materials are delivered. Five of the needed wells are on injection at this time, and it is estimated that 12 of the 13 wells will be on injection by the fourth quarter of this year. One of the wells is yet to be drilled.

Shown in Figure 5 is the areal sweep that has been indicated by the potentiometric model. From this pattern the sweep efficiency has been estimated at 77 percent. Additional potentiometric model studies are being made to determine improvements in the sweep efficiency by shifting of rates and possible addition of new wells.

A factor of 80 percent was applied to recovery calculations to represent bypassing of oil due to permeability differences in the formation. This figure can be substantiated by permeability distribution calculations[3] using air permeability determinations from core analysis.

Using the 69 percent recovery factor determined by laboratory work with Block 31 Devonian crude and applying the above sweep and channel factors, the in-place oil recovery has been calculated as 42 percent.

ACKNOWLEDGMENT

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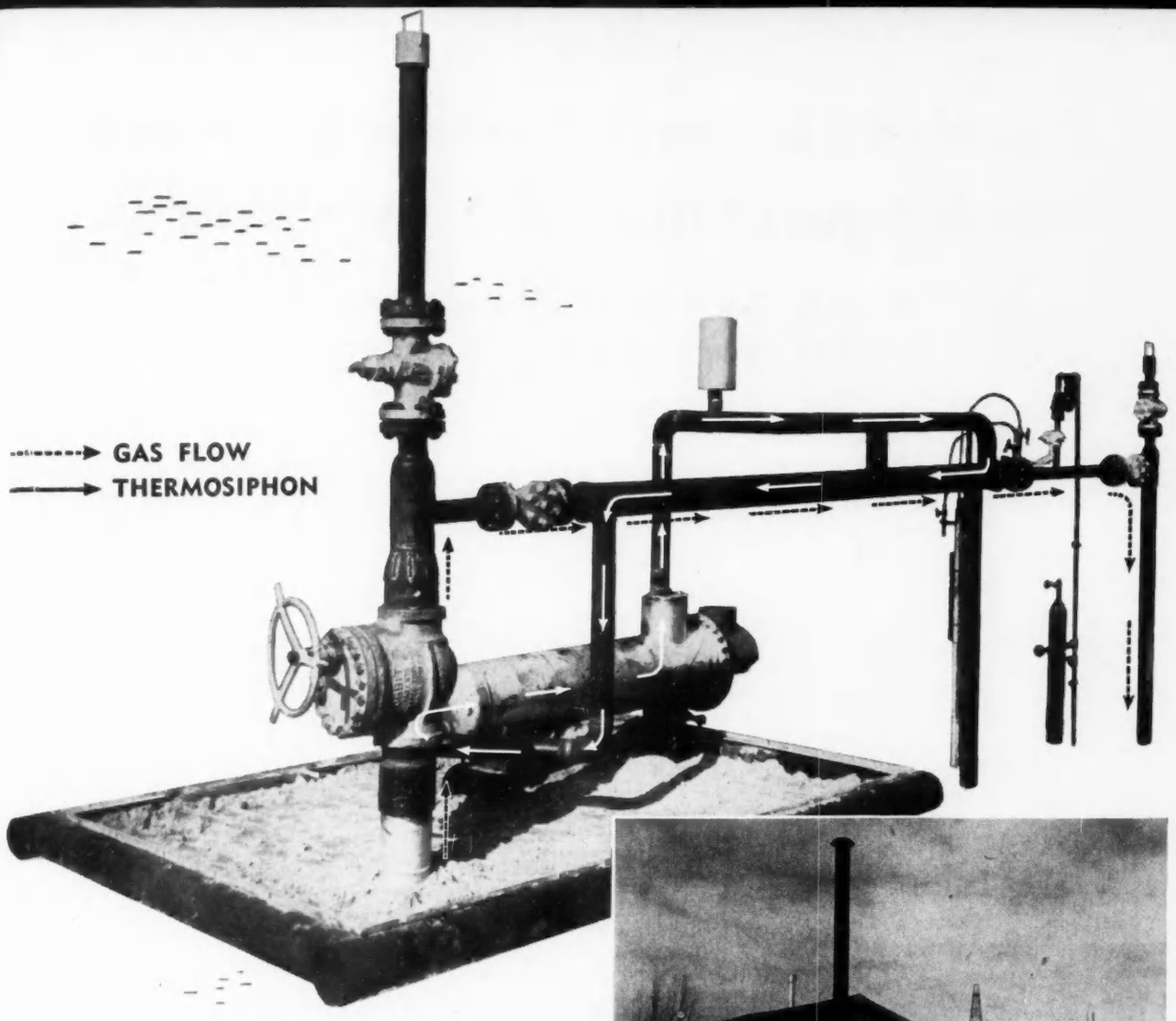
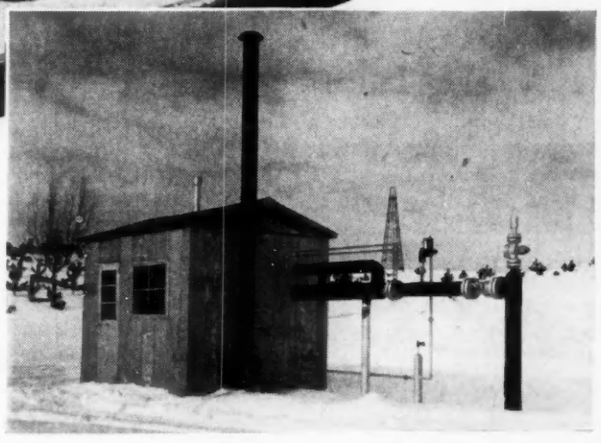
REFERENCES

[1] Miller, C. C., Dyes, A. B., and Hutchinson, C. A. Jr., "The Estimation of Permeability and Reservoir Pressure from Bottom Hole Pressure Build-Up Characteristics," T. P. 2849, *Trans. AIME*, April, 1950.

[2] Whorton, L. P. and Kieschnick, W. F. Jr., "A Preliminary Report on Oil Recovery by High Pressure Gas Injection," presented at the Mid-Continent District Meeting of the API Division of Production, Oklahoma City, March 29-31, 1950.

[3] Stiles, W. E., "Use of Permeability Distribution in Water Flood Calculations," T. P. 2513, *Trans. AIME*, Vol. 186, 1949.





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Guarded Electrode System Improves Log Interpretation of Lower Wilcox

Reasonable Accuracy Can Be Obtained in Interpreting Electric Logs Of Lower Wilcox When Using the Current Focusing System

By

R. C. HOWARD
Gulf Oil Corporation
Houston

and

R. H. WINN
Halliburton Oil Well Cementing Company
Houston

REASONABLY accurate interpretations of the Lower Wilcox in the Upper Texas Gulf Coast are possible with the "automatic current focusing" or "guarded electrode" system of electric logging. Fully developed in recent years, this new logging method requires that the drilling fluid be of relatively low resistivity and low water loss for optimum results. Because of the erratic lithology of the Lower Wilcox which is interspersed with lignite streaks that distort conventional electric logs, it has been difficult to obtain an accurate interpretation of logs made in this section. As a result, considerable time and money have been spent in coring, drill-stem testing, etc., in an attempt to better evaluate these formations. Application of the guarded electrode system to Lower Wilcox interpretation problems has accounted for big cuts in well costs.

An approach to any Lower Wilcox drilling prospect along the Upper Gulf Coast region may be had by considering the geological and electrical logging problems in the vicinity of the New Ulm field of Austin County, Texas. Stratigraphic classification[1] of the Eocene system shows the Wilcox group to be divided into three formations: Sabinetown, Rockdale and Seguin. These can be recognized at the surface outcrops and can be used as mappable horizons at the surface or near surface (500 feet). These subdivisions are poorly defined by conventional electric log correlation in this area. Furthermore there are no diagnostic faunal which can be recognized for differentiation. A definite change in lithologic character within the Wilcox group is recognized on the electric log and this change is being interpreted to be the disconformity between the Sabinetown and Rockdale formations at the surface. In this discussion, the Wilcox has been divided into two formations: the upper or Sabinetown and the lower, which includes the Rockdale and Seguin formations.

The Lower Wilcox is interpreted to lie approximately 2200 feet below the contact of the Wilcox-Claiborne groups in the New Ulm field. It is below this contact that productive sands are encountered. These sands are characteristically cross-bedded, fine grained sand members separated by thin stringers of lignite and lignitic shales. Detailed correlations of these sand members are very difficult to make. Since each Wilcox producing well is likely to be an individual oil field draining an unknown area, intelligent electric log interpretation of each well is highly desirable.

Figure 1 is a stratigraphic, isometric projection of six wells in the New Ulm field. Change in the lithologic character that marks the disconformity between the upper and lower Wilcox is evident.

The conventional log made in a well drilled with muds of a resistivity of approximately one ohmmeter is inadequate for reservoir analysis because of (1) the effects of the invasion of mud filtrate, and (2) the shielding and distortion of the long lateral curve by the lignite streaks and lignitic shales.

Figure 2 illustrates the effect of invasion. Figure 2-A is a section of a log of a gas and condensate producing reservoir made immediately after the section was drilled. The section

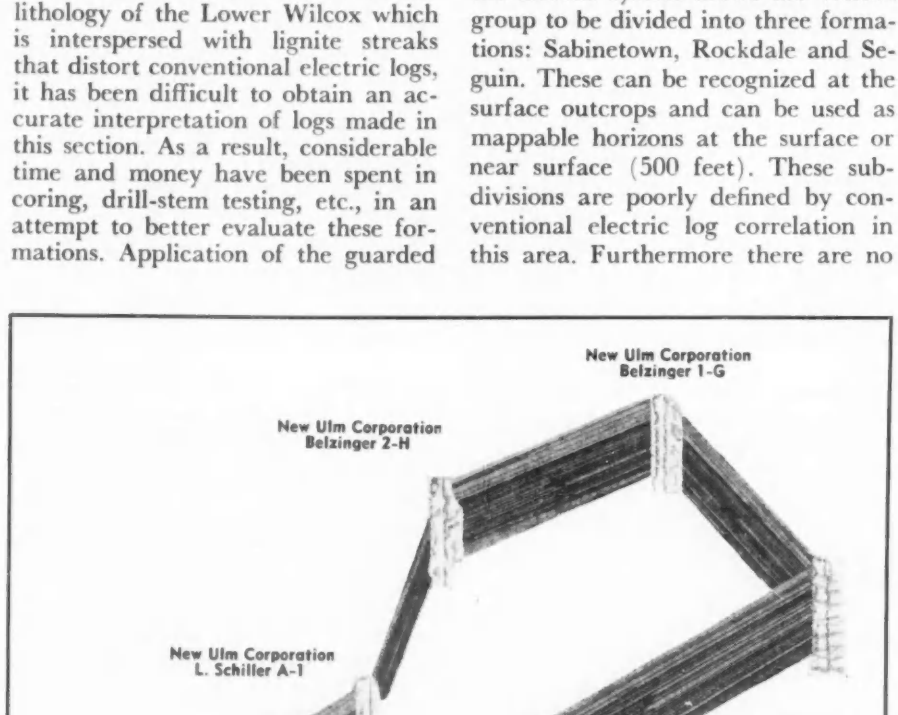

FIGURE 1. Isometric projection of six wells in New Ulm field of Austin County, Texas.

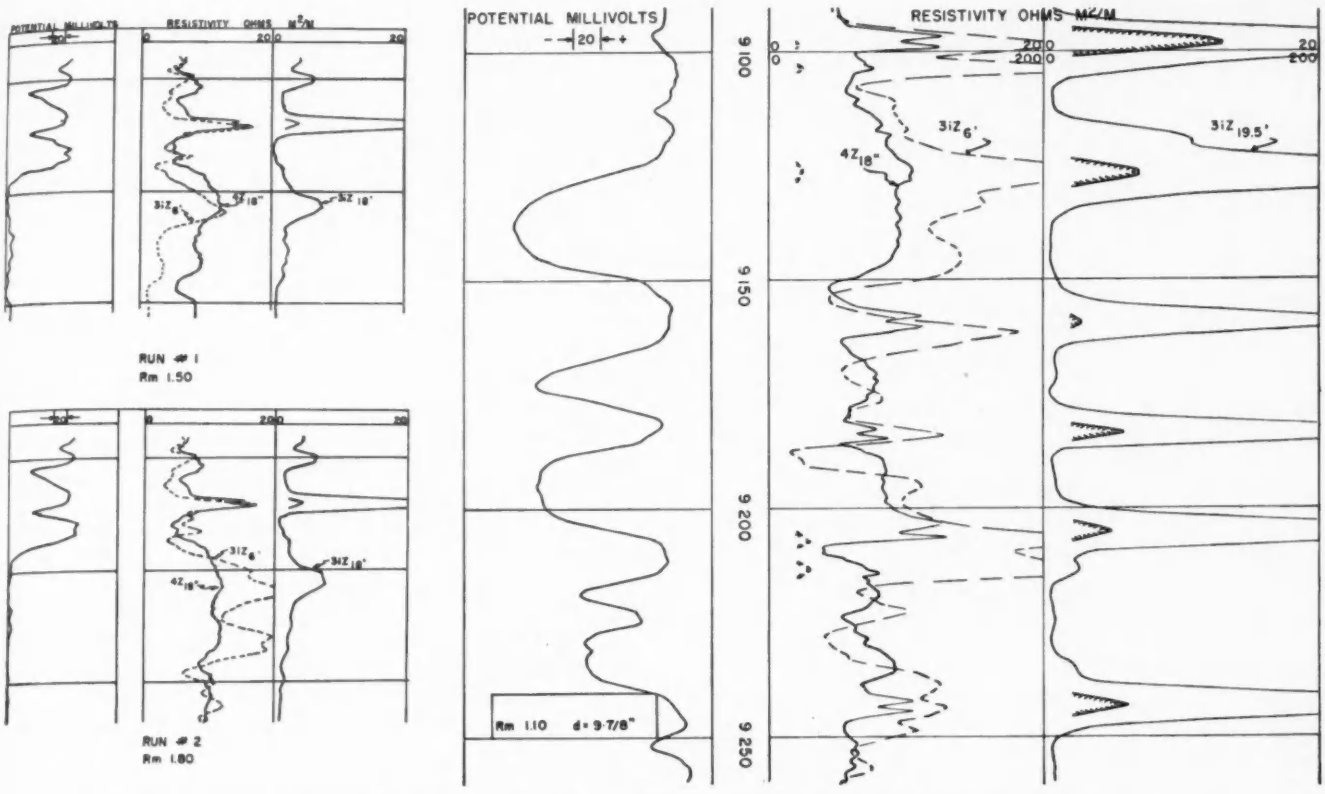

FIGURE 2A (top) 2B (bottom). Effect of invasion of high resistivity mud filtrate on Lower Wilcox. Time between runs eight days. Water loss 6cc/30 inches.

FIGURE 3 (right). Typical occurrence of lignite streaks above and below sands in Lower Wilcox.

was drilled with a mud of 1.5 ohmmeters and the log was made in this mud. Figure 2-B is a log of the same section made eight days later. Note that the long lateral (3iZ18′) has not changed appreciably in character or amplitude. However, the intermediate spaced curve (3iZ6′) has been greatly altered by the effect of invasion.

Figure 3 illustrates the typical occurrence of the lignite streaks. Notice that many sands occur immediately below lignite streaks. Effect of these thin resistive sections on the long lateral has been adequately discussed in the literature.[2] However, the apparent resistivity recorded by the long lateral is not representative of the section for a distance of one electrode spacing from the top of the lignite streak. In these "shadow zones" or "shielded zones" the long lateral is virtually meaningless and tells us nothing about the resistivity in these sections. The "shadow zone" or zone of no information can be shortened by the use of a 13-foot lateral (3iZ13′) in addition to the 18-foot or 19-foot lateral. The 13-foot lateral is only slightly affected by invasion in most instances. Figure 4 is an illustration of a producing zone with lignite streaks above and below. The 13-foot lateral (3iZ13′) provides a positive indication of this condition, although the lignite streaks are only 21 feet apart. It is evident, however, that this is a long way from a completely satisfactory log. In addition to the shadow zones, there are zones of "reflection highs,"[3] where the readings of the lateral curve are too high.

Perhaps the most serious objection to the conventional log made in a well drilled with high resistivity mud is the impossibility of an accurate quantitative evaluation of the reservoirs encountered. Quantitative evaluation of the conventional log is dependent upon a reasonably homogeneous reservoir surrounded by a reasonably homogeneous shale.[4] It is also very desirable to have a minimum effect of invasion.[5] It is believed that the examples already discussed are adequate evidence of the difficulty of quantitative log interpretation of the conventional log.

Simultaneous with the increased drilling activity in this area electric logging devices that employ "guarded electrodes" or automatic focusing systems were developed.[6] It was soon evident that the guarded survey was a valuable aid to the interpretation of the conventional survey. Figure 5 is an illustration of the use of the guard when the well is drilled with high resistance mud. Note the sections 9476-9492 feet and 9505-9516 feet. The high apparent resistivity of these sands as compared with the probable water sands at 9368-9388 feet and 9458-9468 feet cannot be attributed to invasion. However, when these values are transposed to the departure curves (Figure 6) it is evident that some speculation concerning the resistivity of the invaded zone and the diameter of the invaded zone must be made before any value of true resistivity can be ascertained. It is also evident that if low-resistivity muds are used, the effect of a variable resistance invaded zone and variable diameter of invaded zone will be numerically less significant. And, the limits of true resistivity are determined much more accurately.

Figure 7 is the theoretical response of the guarded electrode in typical Wilcox section. The expected response is illustrated for a section invaded with 1 ohmmeter and 1/10 ohmmeter mud. The assumptions made in this theoretical derivation are noted among the physical characteristics listed on the illustration.

Figure 8 is an example of a guarded electrode log made in 1.5 ohm mud. Note the close agreement between the anticipated results and those actually obtained. However, it is evident in this example that the apparent resistivity recorded by the guarded electrode in the water sand is dominated

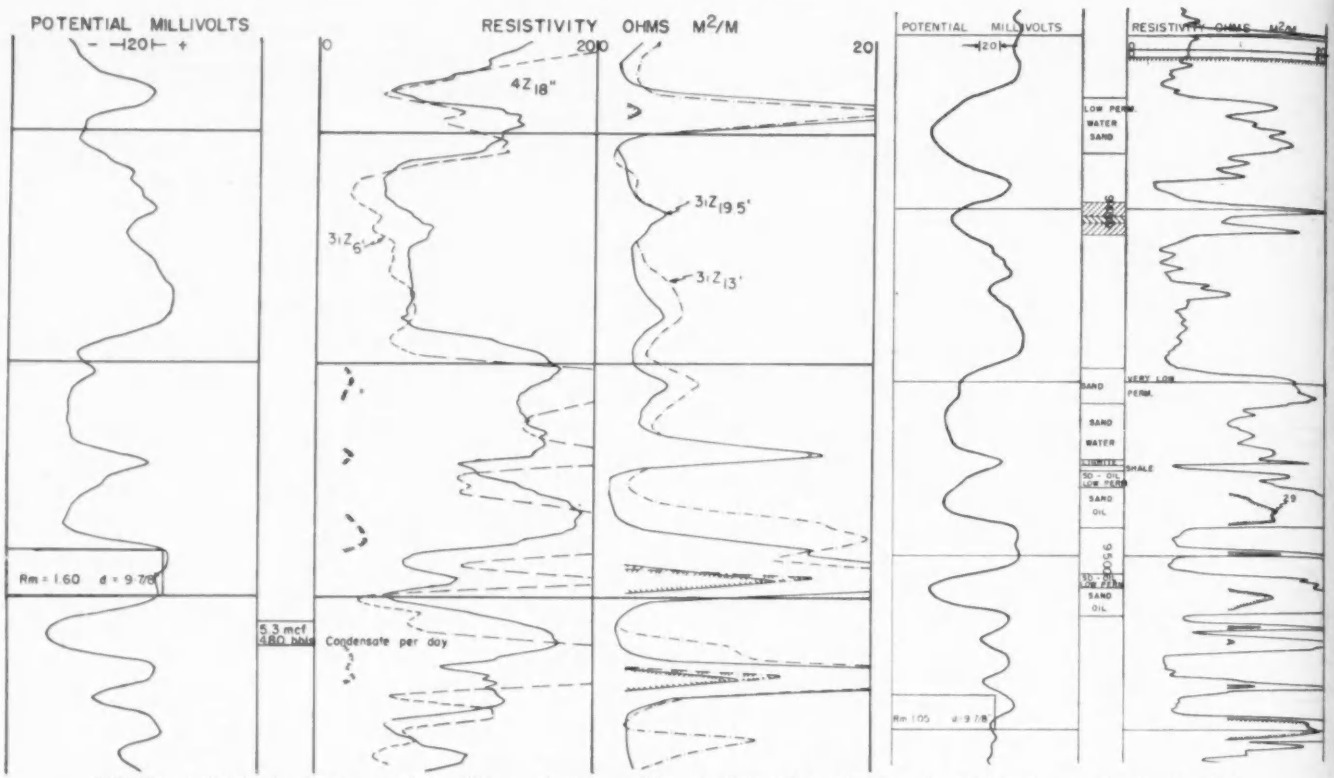

FIGURE 4 (left). Producing sand in Wilcox showing utility of 13-foot lateral when the 19-foot is completely shielded.
FIGURE 5 (right). Guarded electrode log on same well as shown in Figure 4 two weeks between runs. Detailed lithology and high apparent resistivity in producing section are shown.

by the effect of the invasion of the high-resistivity mud-filtrate.

A review of all the facts led to the conclusion that a guarded electrode log made in a well drilled with a mud of low-resistivity and low water-loss would be greatly superior to the conventional log. Since the magnitude of the self-potential curve is largely controlled by the mud resistivity,[7] reducing the mud resistivity will automatically reduce the magnitude of the self-potential anomolies. It is important not to reduce the mud resistivity too far. An examination of logs in the area indicated that a mud resistivity of four to five times resistivity of the water encountered in these horizons would yield enough self-potential provided the self-potential curve is recorded on an amplified scale. Sufficient potential is recorded to permit the calculation of connate water resistivity.

Produced waters were collected from the wells in the area and their resistivities measured. All of the samples producing from the 9000 feet to 10,000 feet interval in the New Ulm field measured 0.018 ohmmeters at the reservoir temperature. Two samples from 10,000 feet to 10,150 feet measured 0.024 ohmmeters at the reservoir temperatures. Calculation from the S. P. log using mud filtrate resistivity to compute mud activity gave 0.025 ohmmeters as the water resistivity in the depth range of 9000-10,150 feet. Therefore, it was decided to drill with a mud of approximately 0.10 ohmmeters at the reservoir temperature.

Gulf Oil Corporation's 1 Luedke was selected as a test well. The Wilcox section below 9300 feet was drilled with a starch-organic colloid-oil-emulsion mud. Resistivity of the mud was maintained at approximately 0.2 ohmmeters at reservoir temperature by the addition of salt to the water phase. Characteristics of the mud on this well were not controlled as rigidly as on later wells. Figure 9 shows a portion of the guarded electrode log made on this well. The long lateral curve (3iZ19') is superimposed on the guarded log for comparison purposes.

It is evident that the sand at 9574 to 9591 feet has much more resistivity than the sand at 9500 to 9523 feet. The well was perforated from 9574 feet to 9591 feet and produced gas and condensate. Completion and production history indicate that the permeability of the reservoir is low. A comparison of the apparent resistivities of the 19-foot lateral and the guarded electrode log on the upper water sand, together with the knowledge that the interstitial water resistivity is 0.02 ohmmeters, indicates that the diameter of the invaded zone is twice the hole diameter and the resistivity of the invaded zone is approximately 50 times the mud resistivity.

Assuming that these same invasion conditions prevail in the lower sand, the true resistivity of the oil sand is 7.4 ohmmeters and the average water saturation is 35 percent, if $S^2 = \frac{R_o}{R_t}$

Figure 6 shows the departure curves that apply for a nine-inch hole when the diameter of the invaded zone is twice the hole diameter. Point A represents the water sand. Point B represents the producing sand.

This method of evaluation of the resistive sand is subject to whatever

TABLE 1
Lower Wilcox Reservoir Data

Number of Core Samples	Permeability Range	Average Permeability K	Average Irreducible Water Saturation Swi—%	Average Formation Factor F	Average F / Average $Swi^{2.2}$ (Calculated) = Rt / Rw
19	0.1—0.99	.41	42.6	45.4	297
31	1.0— 9.9	4.65	33.2	39.2	443
41	10.0—29.9	18.90	27.1	35.3	621
21	30.0—49.9	35.3	23.5	33.7	815
17	50.0—99.9	62.5	21.1	30.7	941
9	>100	161.0	19.4	29.9	1103

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error is inherent in the assumption that the invasion characteristics which prevail in a water sand are the same as those in a nearby oil sand. There is also the assumption that the formation factor is nearly identical in the two sands.

To establish the petro-physical characteristics of the lower Wilcox, core samples were analyzed for porosity, permeability, formation factor and irreducible water saturation. Each of these properties were measured on the same sample. Cores from two wells totaling 139 samples were available. Table I shows the averages of these data tabulated according to permeability ranges. The resistivity index exponent (n) was not measured on these samples, but comparisons of the irreducible water data with true resistivities calculated from logs indicate that the resistivity index exponent is 2.2 rather than 2.0.

The evaluation equation[8] may then be expressed

$$S^n = \frac{F \times R_w}{R_t}$$

where: S = Fractional Water Saturation.
F = Formation Factor.
R_w = Interstitial Water Resistivity.
R_t = True Resistivity of Reservoir.
n = Resistivity Index Exponent.

This may be also expressed

$$\frac{F}{S^n} = \frac{R_t}{R_w}$$

If the irreducible minimum water saturation, "Swi" is substituted for the water saturation "S," this becomes:

$$\frac{F}{(Swi)^n} = \frac{R_t}{R_w}$$

The calculation of this ratio for the core analysis available is shown in Table 1.

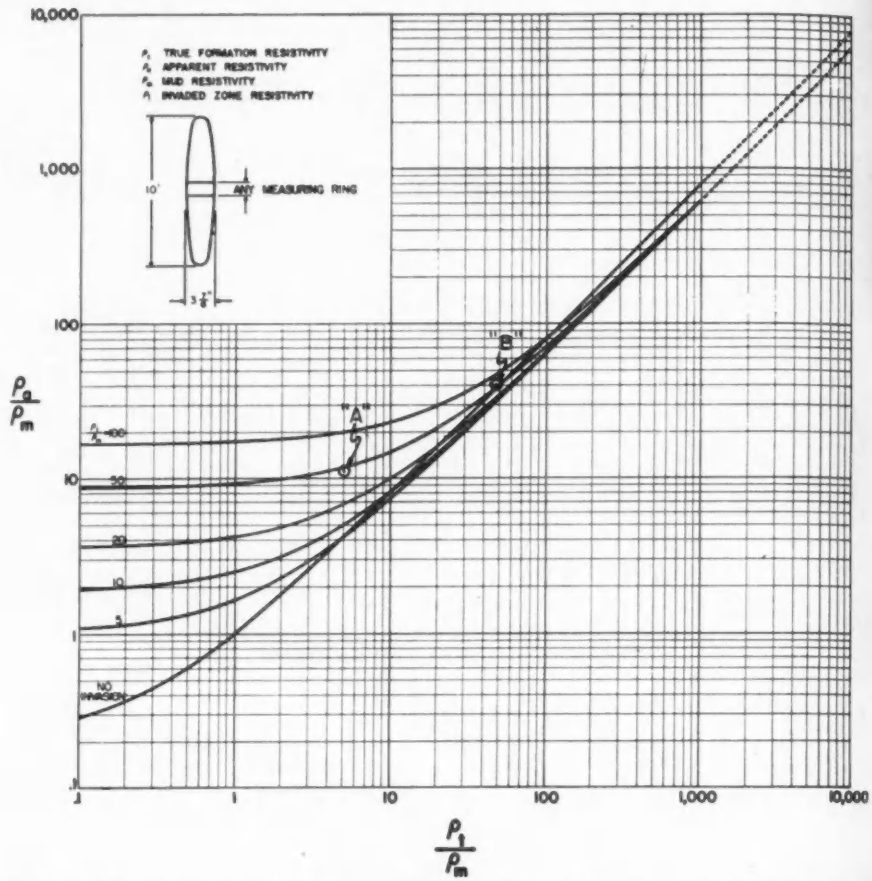
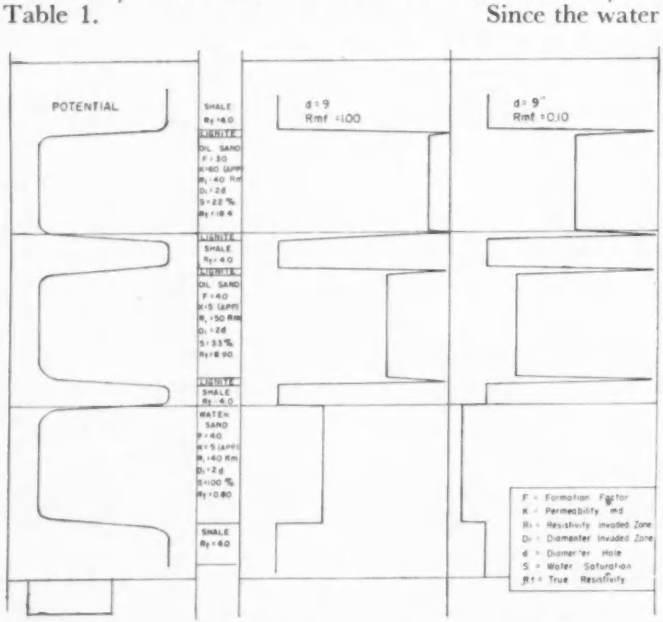


FIGURE 6. Departure curves for 10-foot guarded electrode in 9-inch hole and an invaded zone diameter of 18 inches. (Note: Assumption made in computation may give significant error for P_t/P_m greater than 1000.)

In Figure 10 this calculated ratio of $\frac{F}{(Swi)^{2.2}}$ is plotted against the corresponding value of average permeability "K." If our treatment of the evaluation equation is valid, this ratio is equal to Rt/Rw, the ratio of the true resistivity to the water resistivity.

Since the water resistivity for much of the area has been established, this curve allows an estimation of the order of permeability from the electric log. The material is offered as a tentative method for further investigation. Core data available are insufficient to permit dogmatic conclusions, and the curve in Figure 10 should be considered as a trend rather than a definite line. However, all experience



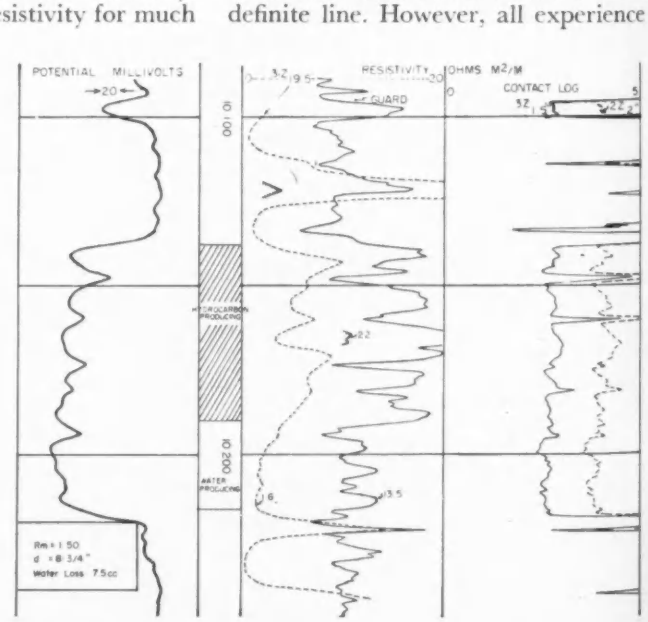


FIGURE 7 (left). Theoretical response of guarded electrode log in typical Wilcox sands.
FIGURE 8 (right). Guarded electrode log made in 1.5 ohmmeter mud. Compare this log with that in Figure 7.

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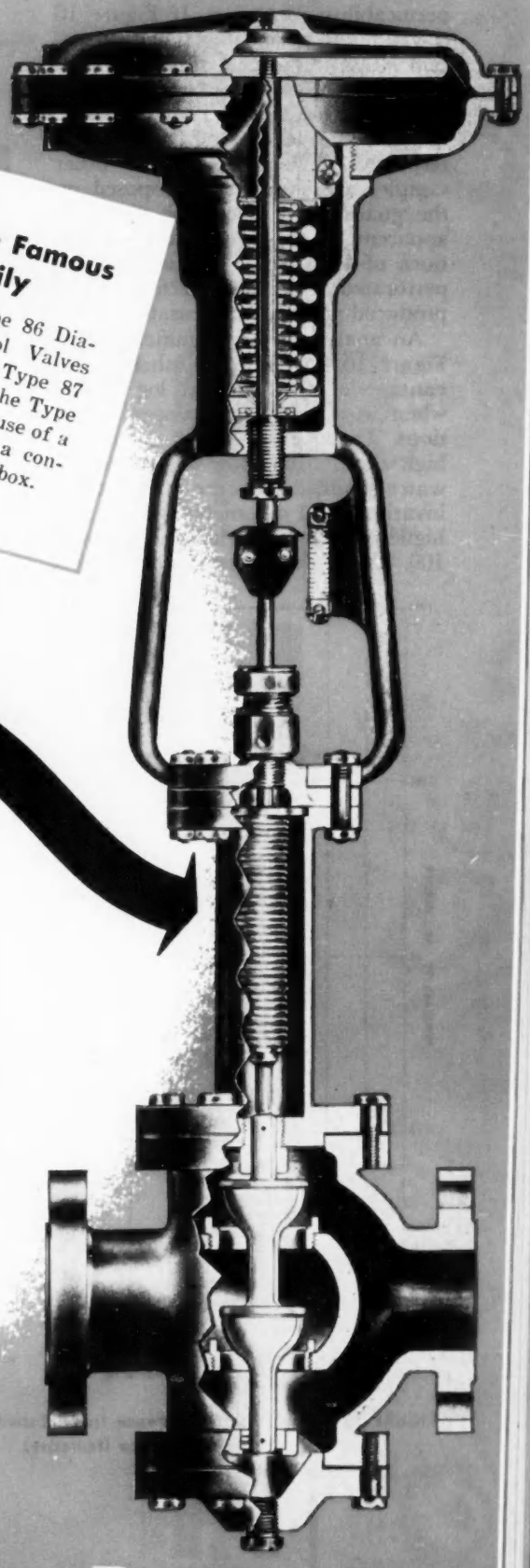

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to date appears to substantiate Figure 10.

Figure 11 is a section of a log of a second well drilled with low-resistivity mud ($R_m = 0.077$). Cores were taken at various intervals and their permeability measured. If Figure 10 is valid, the permeability of the section 9409-9423 feet should be less than one millidarcy. Three samples were taken in this interval. They measured 0.5, 0.98, and less than 0.1 millidarcys respectively. Permeabilities of other samples are shown superimposed on the guarded log. Note the gradients apparent in the two producing sections of this sand. The section was perforated from 9380-9426 feet and produced gas and condensate.

An analysis of the ramifications of Figure 10 points to an inherent advantage of the guarded log system when used under the proper conditions. The question arises as to how high the guarded log might read in water sands, due to the effect of the invasion of 0.1 ohmmeter filtrate. The highest probable formation factor is 100. If the formation factor is 100,

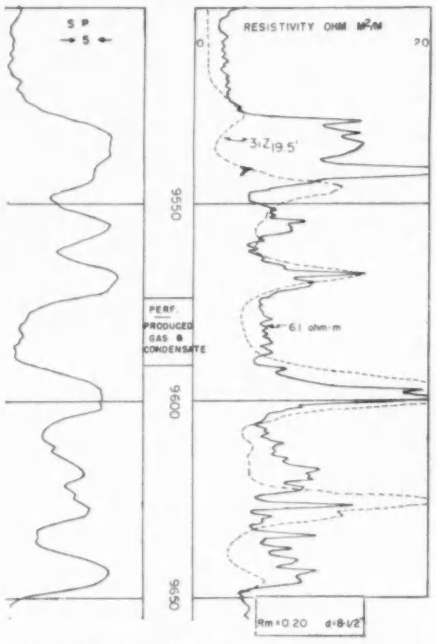

FIGURE 9. Guarded electrode log made in well drilled with 0.20 ohmmeter mud.

and the interstitial water resistivity is 0.02, and presuming 100 percent flushing of the interstitial water by the filtrate, then the guarded log would read as high as 4.8 ohmmeters if the diameter of the invaded zone is 45 inches and the hole is 9 inches.[9] If the diameter of the invaded zone is only 18 inches then the guard would read 3.0 ohmmeters. Since the diameter of the invaded zone is likely to be less when the contrast in resistivities between the filtrate and the interstitial water is low, it seems quite reasonable to say that 4.8 ohmmeters would be the maximum apparent resistivity due to the invasion of filtrate. Figure 10 would indicate that the minimum resistivity of commercial sands would be 6.0-8.0 ohmmeters and the expected apparent resistivity of the guard would be 5-6.5 ohmmeters. Therefore, the only "zone of indeterminability" would be in zones of less than 1.0 millidarcy. None of the reservoirs encountered in this area to date are sufficiently thick to make 1.0 millidarcy of commercial interest.

Figure 12 is a section from the same well shown in Figure 11. The

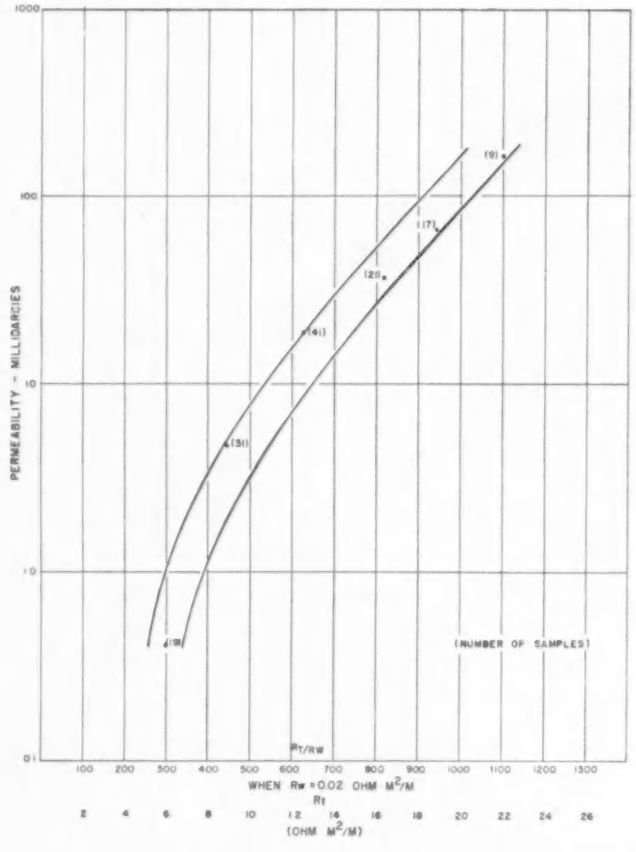

FIGURE 10 (above). Relation between true resistivity and permeability in Lower Wilcox (tentative).

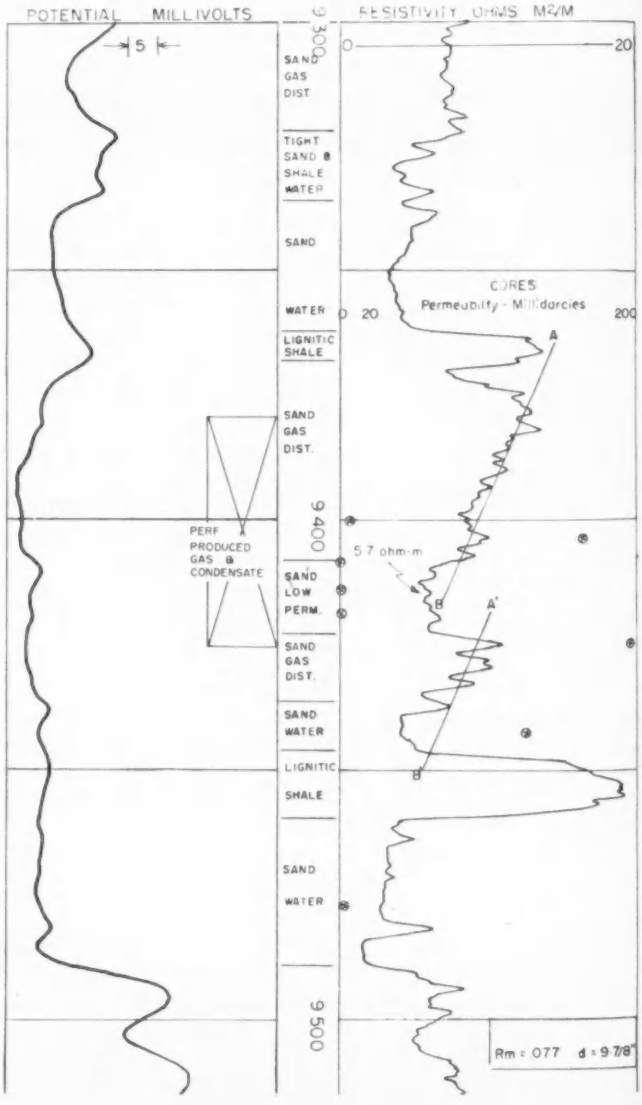

FIGURE 11 (right). Guarded electrode log over producing section in Lower Wilcox drilled with 0.077 ohmmeter mud.

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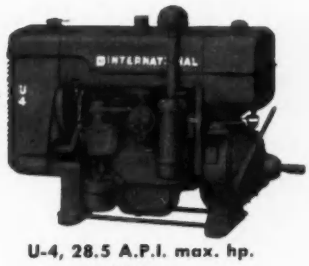

U-4, 28.5 A.P.I. max. hp. at 1800 r.p.m.

U-9, 49 A.P.I. max. hp. at 1500 r.p.m.

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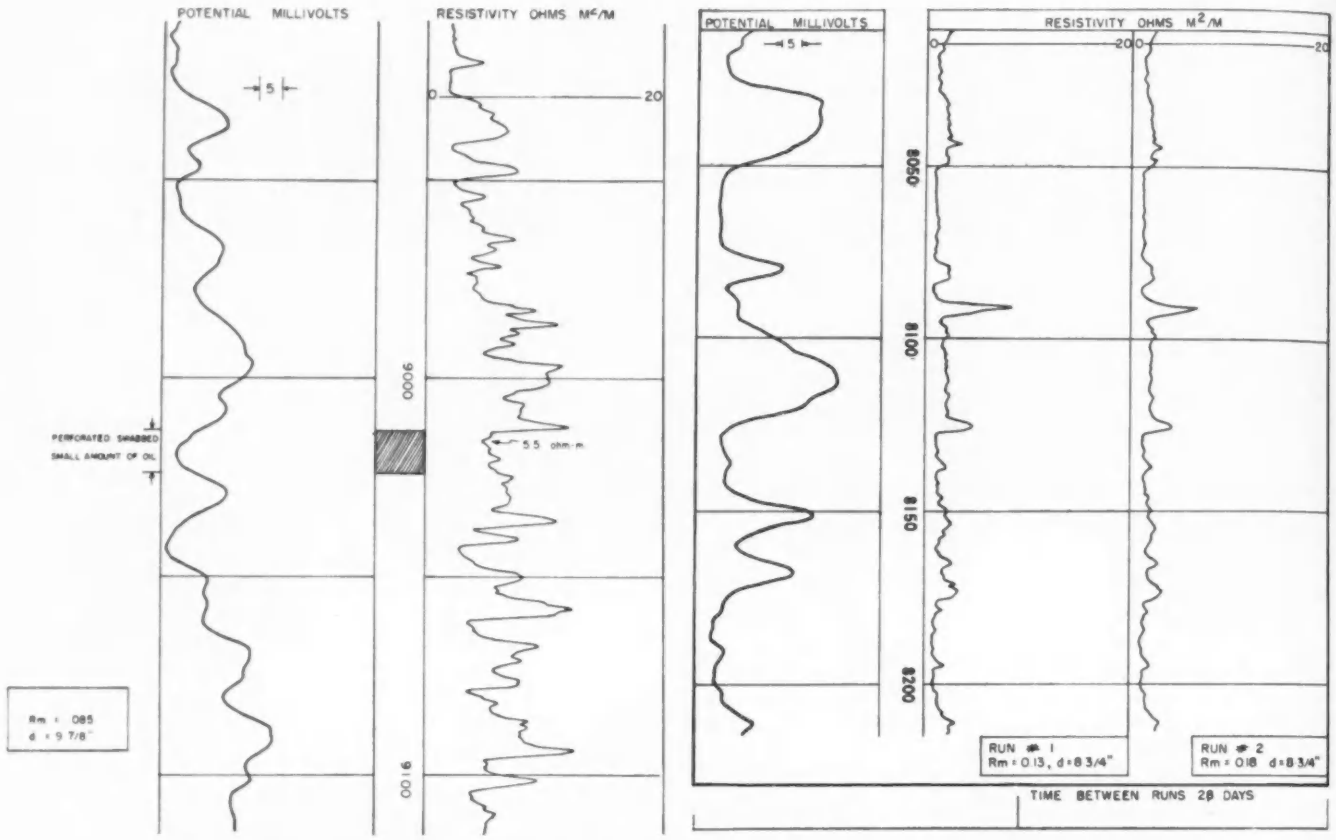


FIGURE 12 (left). Guarded log over very low permeable hydrocarbon zone in Lower Wilcox drilled with 0.085 ohmmeter mud.
FIGURE 13 (right). Two guarded electrode logs made on same well 28 days apart to show negligible effect of invasion when mud resistivity is maintained at approximately 0.10 ohmmeters.

section 9014-9024 feet appears to correlate with the producing section of an offset well. Although the guarded log evaluation indicated that this sand was of insufficient permeability to be of interest, a production test was made. The section was perforated from 9013 to 9024 feet and swabbed insufficient oil to be a commercial producer. This section was abandoned and the well completed in the lower section previously shown.

Figure 13 shows two guarded logs made of the same section four weeks apart. This comparison is definite proof that the adverse effects of invasion have been made small and held nearly constant by this logging program.

The program recommended to utilize this information is to drill to a point just above probable production with normal drilling mud and make a conventional survey. Then change the mud system to a starch-organic colloid, low-resistivity mud. This may be an oil emulsion mud, if desired. The resistivity of the water phase should be lowered with sodium chloride. A concentration of approximately 25,000 parts per million in the water phase is recommended for the New Ulm area. The use of other salts to reduce resistivity should be avoided as they might be adsorbed upon clay particles in the sand and fail to give a controlled mud filtrate resistivity. Low water loss characteristics are also desirable and are readily attained with this mud. Viscosity and weight control are not difficult with this type mud.

Cost of this program is somewhat higher than the use of normal muds. However, any comparison of costs must take into account the costs of production tests. A comparison of two wells drilled in the New Ulm field has indicated rather conclusive economic results. Well 1 was drilled without controlled drilling fluids and was logged with a conventional logging instrument. Eleven production tests were made in this well before a commercial hydrocarbon sand was located.

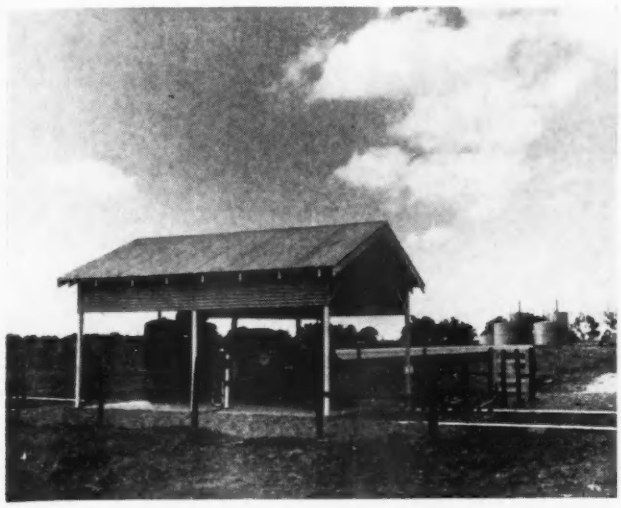
Well 2 recently was drilled with controlled drilling fluids and logged with the guarded electrode from which three hydrocarbon zones were readily recognized. Two tests were made before final completion of this well.

Cost comparison of these two wells show that 16 percent saving was made by this new drilling and logging technique. These savings can be considered as directly related to the quality of the electric log. This comparison is not necessarily to be used as a percentage yardstick, but simply is intended to point out the advantages of the quality of log obtained in Well 2.

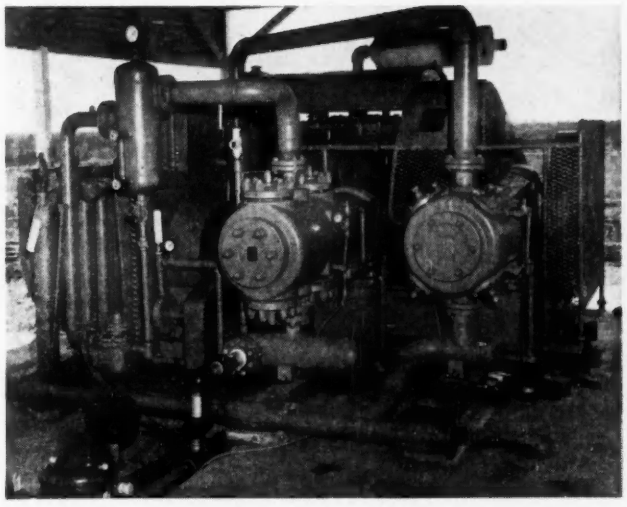
It is indicated where the effect of filtrates distorts the conventional log to prohibit a reasonable interpretation, use of the automatic current focusing or guarded electrode system in a controlled mud will permit a fairly accurate evaluation of a sedimentary section. Presence of hydrocarbons in commercial quantities is readily apparent and the order of permeability indicated.

REFERENCES

[1] Plummer, F. Bulletin 3232, Univ. of Texas, 1932. Pg. 530.
[2] L. G. Chombart, "Factors Involved in Practical Electric Log Analysis," A Symposium of Subsurface Logging Techniques, University Press, Oklahoma University.
[3] Schlumberger Document 4 "Interpretation Handbook for Resistivity Logs."
[4] Schlumberger Document 3 "Resistivity Departure Curves."
[5] DeWitte, L. "Resistivity and Saturation Distribution in Infiltered Zones of Porous Formations," *Oil and Gas Journal*, July 27, 1950.
[6] J. E. Owen and W. J. Greer. "The Guard Electrode Logging System," *Petroleum Technology*, December, 1951.
[7] M. R. J. Wyllie. "A Quantitative Analysis of the Electrochemical Component of the S. P. Curve," *AIME Tech. Pub.* 2511.
[8] M. R. J. Wyllie. "An Investigation of the Electrokinetic Component of the S. P. Curve," *AIME Tech. Pub.* 2940.
[9] G. E. Archie. "Electrical Resistivity Log as an Aid in Determining Some Reservoir Characteristics," *AIME Tech. Pub.* 1422.
[10] Electrical Well Services Laboratory Bulletin, Halliburton Oil Well Cementing Company.



Well-ventilated housing over 80-horsepower, two-stage compressor which supplies gas for rotative gas lift system. Suction volume reservoir, 30-inch by 160 feet, shown in background, increased efficiency of installation in Nash Dome of Brazoria County, Texas.



Working end of 80-horsepower, 8 x 4½ x 9-inch compressor installed in Nash field by Jim Harrison, Jr., operator. At suction pressure of 25 pounds gauge and discharge pressure of 650 pounds gauge, the compressor handles about 450,000 cubic feet daily.

Getting Most From Rotative Gas Lift

You Can Get More for Your Money Merely by Considering Factors That Govern Compressor Efficiency and Output

By **BOBBY MOORE**, Compressor Division
Wilson Supply Company, Houston

HIGHER efficiencies at less investment and operating costs are obtained from rotative or closed gas lift systems by following a few simple engineering principles that stem from the operating characteristics of the compressor. By recognizing the factors that affect compressor efficiency and output, and designing the system to take advantage of these factors, less horsepower may be installed to furnish adequate volumes of gas.

When designing closed gas lift systems for new wells or when revamping existing wells, there are several important factors that must be considered and evaluated carefully to get the job done at less cost. The most important of these is the compressor, which is the heart of the system, for it supplies the energy that lifts fluids in rotative gas lift. Proper selection of a compressor and utilizing it at its maximum efficiency will affect economies in original investment and future operating expenses. There must be ample makeup gas available for engine fuel and for charging wells once they have been bled down for pulling or other reasons. Wells should be synchronized (in the case of intermitting gas lift) as nearly as possible so that gas demand upon the system is relatively constant over a 24-hour period. Volume reservoirs or both the compressor discharge and suction are important where it is difficult to arrange well schedules so that the volume demand is constant. Consideration should be given the piping system, prevention of hydrates and design of foundation and compressor building.

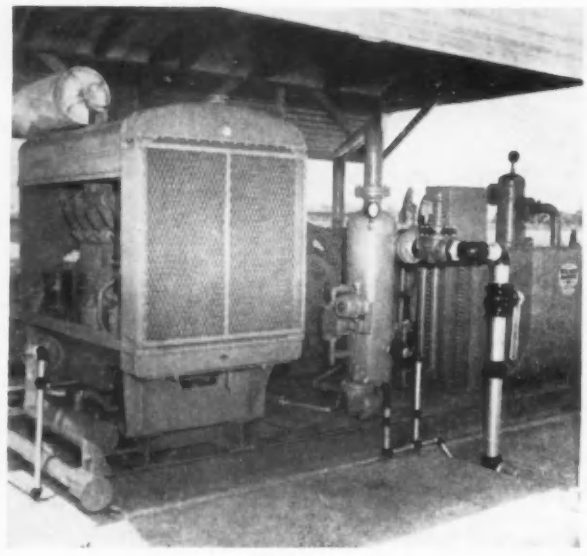
Compressor Requirements

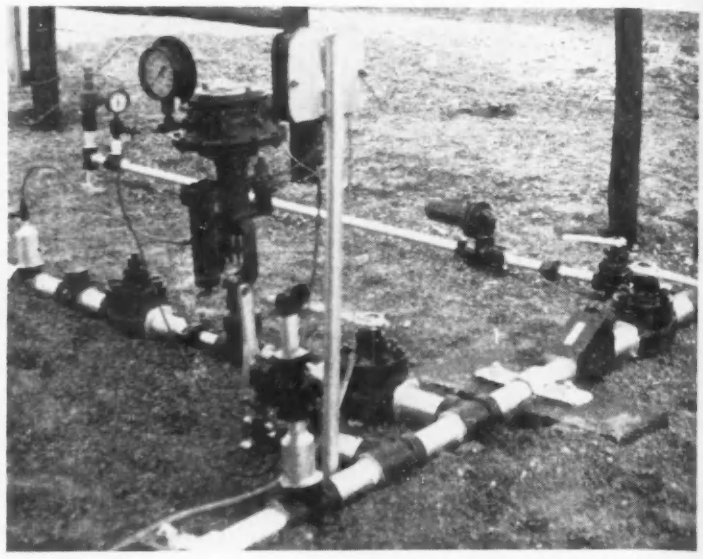
Three important factors must be evaluated in selecting a compressor for efficient gas lift service: (1) suction pressure, (2) discharge pressure, and (3) volume of gas required per day. Arriving at a desirable compressor suction pressure is of primary concern for it influences cost of compression and establishes the back pressure to be held against gas lift wells. Flowing or pumping wells producing into the same lease separator must be considered in selecting this back pressure. Average suction pressure for compressors used in closed gas lift service is about 30 pounds per square inch gauge, but it ranges from 20 to 59 psig, with a few scattered pressures outside this range.

Discharge pressures are determined by the type of well and injection depths. They range from 350 to 1000 pounds psig. A general rule for arriving at a discharge pressure is to use 100 pounds pressure for every 1000 feet of injection depth. If the lowest valve in the string is placed at 10,000 feet, according to the rule of thumb, a discharge pressure of about 1000 pounds will be required.

Higher suction pressures are generally associated with higher discharge pressures, and some typical examples are: 25 pounds suction to 500 pounds discharge; 30 pounds suction to 600 pounds discharge; 30 pounds suction to 700 pounds discharge; 40 pounds suction to 800 discharge and 50 pounds suction to 1000 pound discharge.

Most compressors used in gas lift service are of the two-stage type. Compression ratios are calculated from absolute pressures, which equal gauge readings plus 14.7 pounds at





LEFT. Suction to compressor is through this three-inch line which is flanged to inlet gas scrubber. Note pressure-reducing valve on suction line which maintians a steady suction pressure of about 25 pounds gauge.

RIGHT. Discharge piping incorporates several desirable features. Regulator in bypass line prevents excessive pressure in system. High-pressure gas will pop back into suction volume reservoir. Note that check valve is placed beyond this bypass point. One-inch line supplies gas to engine starter and may be used for fuel.

sea level. At a compression ratio of 13 to 1, approximately 160 horsepower per million cubic feet daily are required at the following pressures:

Pressure in Pounds Psig	
Suction	Discharge
25	505
30	570
35	635
40	700
45	765

Although each set of pressures require 160 horsepower per million cubic feet daily to compress, an additional compressor cost of 5 to 8 percent is incurred by the higher pressure ranges.

While it takes 160 horsepower to compress 1 million cubic feet of gas per day with a suction pressure of 30 pounds psig and a discharge pressure of 570 pounds gauge, it will take about 248 horsepower to compress the same volume per day with a suction pressure of zero pounds gauge and a discharge pressure of 570 pounds gauge. This example shows the effect on compressor horsepower requirements when the suction pressures are low. In order to prevent dropping to low values on the suction side, it is better to go somewhat higher on the discharge side. By doing so, the compression ratio can be kept lower. For example, if the desired pressure differential in the gas lift system is 540 pounds, less horsepower is required if the suction is 30 and the discharge 570 pounds gauge, than if the suction were 20 pounds and the discharge 560 pounds gauge. The first set of pressures gives a compression ratio of 13, while the latter results in a ratio of 16.4. It would require less horsepower if the suction pressure were 40 pounds and the discharge 580 pounds (differential pressure remaining at 540 pounds) to give a compression ratio of 10.9.

If the momentary demand for high-pressure gas during injection periods is considerably greater than the compressor output, volume reservoirs on both the suction and discharge offer several advantages. Sufficient gas can be stored so that smaller compressors may be used efficiently. Suction and discharge reservoirs are especially beneficial in small closed systems where some of the wells are on intermittent flow. If enough wells are included in the system, it will be taking gas continually, and the demand can be regulated to some extent. However, with the smaller systems, up to six or eight wells, volume reservoirs are usually needed.

Plugged and abandoned well used as discharge reservoir. Cement retainer and plug at 1150 feet in 10¾-inch casing make pressure-tight chamber. Well is equipped with two-inch tubing so liquids may be purged periodically. Gas flow to and from well is at left.

Better results in gas lifting are obtained by slugging certain types of wells instead of allowing the gas to trickle into the casing. When an intermitter opens, an adequate slug of gas is available from the discharge reservoir. A good casing pressure buildup results which is conducive to efficient gas lift operations. If the wells require 1000 cubic feet per minute for efficient lifting, and the compressor only puts out 500 cubic feet per minute, the remaining 500 cubic feet are taken from the discharge reservoir. As soon as the intermitter closes, the compressor refills the discharge reservoir with a ready supply for another peak demand period.

Since it is practically impossible to synchronize intermitter clocks from well to well, there will be periods when more than one well takes gas on the injection cycle. When two wells are on the injection cycle, the discharge volume reservoir is very useful in providing ample volumes of gas for kicking both wells at the same time.

For systems containing 2 to 8 wells intermitting from 15 to 30 minutes apart, volume of discharge reservoir should be about 350 cubic feet. How-

Emulsion Treaters

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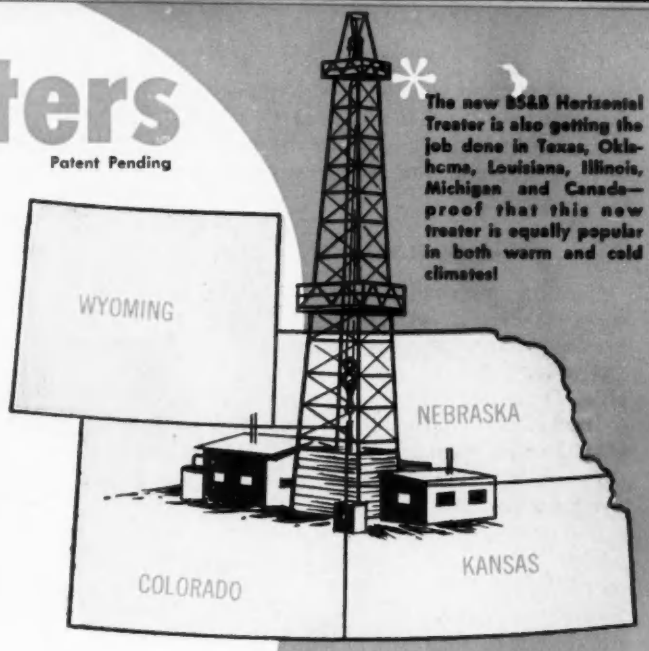

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peline requirements are rigid as to water content, and the BS&B orizontal Emulsion Treater is keeping the water content within the inimum. The treaters, in some cases, are handling several wells th different emulsion characteristics.

All Operators Like the Steam Chest

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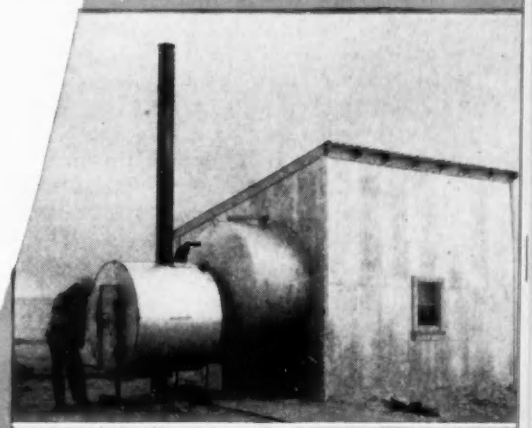

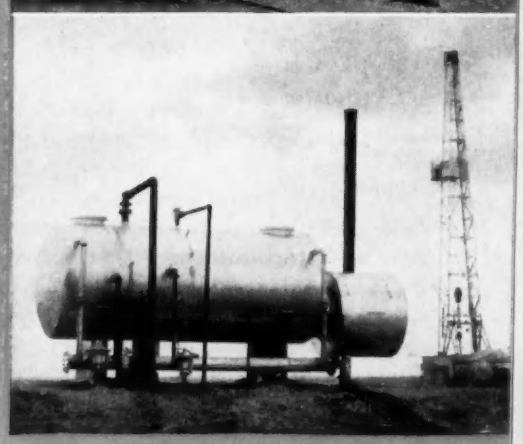

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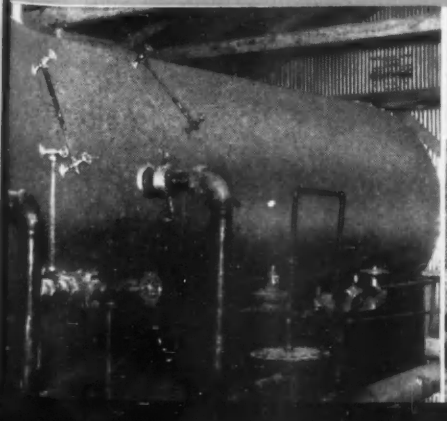

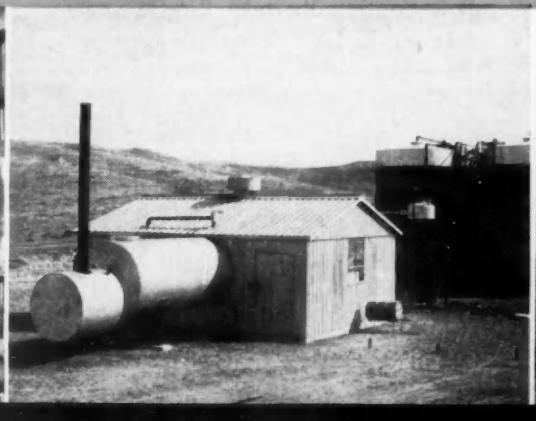

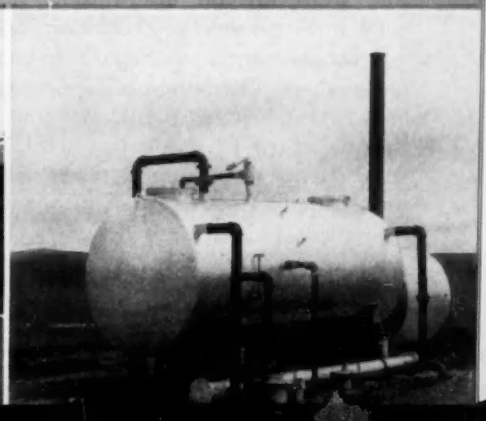

ever, the actual volume of a discharge reservoir required in each particular case should be estimated on the basis of peak demand and compressor output.

Suction Reservoirs

Suction reservoirs level out pressures on the suction side of the compressor so that a constant volume of gas at a constant pressure is available. It should have a volume equal to twice that of the discharge reservoir. In this manner, the back pressure can be lowered so that wells will not have to flow against a high separator pressure. The suction reservoir under these conditions will contain ample gas to keep the compressor suction flooded so that it will deliver its rated output efficiently. Pressure on the suction will be highest at the end of a flowing head, after fluid is already in the tank. The compressor will continually pull this pressure down until it will be at a low point before the next well flows into the separator, to build up the pressure in the suction reservoir. A suction pressure regulator will maintain an even pressure on the compressor.

Large diameter pipe is more economical per cubic foot of volume and when available should be used. Sixteen-inch outside diameter casing is a desirable size for discharge volume reservoirs, while 30-inch O. D. pipe is best for suction reservoirs where a volume of 700 cubic feet is needed.

In some closed gas lift systems, the casing annulus of at least one well equipped with wire line controlled valves is used as the discharge reservoir. There are pressure-operated valves which also make the annulus available for discharge reservoirs. Plugged and abandoned wells have been converted into discharge reservoirs where the casing is in good condition and is of a satisfactory size and weight.

An Eight-Well System

To illustrate the value of careful consideration of the compressor and the effect of good planning, an eight-well gas lift lease is described. Six of the wells are on intermittent flow with a 30-minute cycle and two wells are on constant flow. Separator back pressure is 30 pounds and injection pressure is 700 pounds. Estimated volume of gas needed daily is 860,000 cubic feet. A 150-horsepower compressor will handle this job efficiently provided the system is designed correctly.

Filters may be used on the compressor suction to knock out solids and liquids. This installation is located in the Pierce Junction field of Harris County, Texas, and handles about 2 million cubic feet per day.

Assuming that each well takes the same volume of gas daily, 107,500 cubic feet daily is needed per well. Since the two constant flow wells are continually taking and giving up gas, they will have no appreciable effect on suction or discharge pressure. For the six intermitting wells, 645,000 cubic feet daily are required.

When properly scheduled, one of the six wells will intermit every five minutes for a period of two minutes, then all intermitters will be closed for three minutes. Another well will open for two minutes and the cycle repeated.

A pressure-reducing regulator maintains suction pressure at 30 pounds gauge. Discharge pressure in the system will vary, but will average about 700 pounds per square inch. In placing this system in operation, a discharge pressure of 730 pounds will be used, and the Number 1 well opened at 12 noon.

Daily output of the compressor is 860,000 cubic feet, sufficient to meet the requirements of this eight-well lease. Two of the wells on constant flow continually take 215,000 cubic feet per day and dump this amount in the separators. The problem in design arises from the fluctuation in gas demand by the six intermitting wells which require 645,000 cubic feet daily. Rated capacity of the compressor is 597 cubic feet per minute. Of this volume, 149 cfm supply the continuous flow gas lift wells. The remaining 448 cubic feet per minute must be used to lift the six intermitting wells. For the purpose of buildup, the remaining compressor capacity, 645,000 cubic feet daily or 448 cfm, will be used to calculate the correct sizes of the discharge and suction reservoirs.

Each one of the intermitting wells will kick off 48 times daily, and use 2239 standard cubic feet of gas each kick which is of two minutes duration. The compressor can deliver only 896 cubic feet of gas during this two minutes, so the remainder of the gas required (1343 standard cubic feet) must come from the discharge reservoir, which has a volume of 350 cubic feet. Loss of 1343 standard cubic feet of gas from the reservoir will lower the pressure 56.5 pounds psi, and is calculated as follows:

$$\frac{1343}{350} \times 14.7 = 56.6 \text{ psi}$$

Starting pressure at the beginning of the cycle was 730 pounds gauge. At the end of the injection period for well number one, the discharge pressure dropped to 673.5 pounds. The compressor will operate for three minutes while all intermitters are closed, thus building up the reservoir pressure to its original 730 pounds. At the rate of 448 cubic feet per minute for three minutes, volume replaced in the reservoir is 1344 cubic feet. During the next injection period this volume again is taken from the reservoir and paid back at the end of the next injection period.

At 12:05 P.M., well Number 2 opens up for two minutes and the discharge pressure drops to 673.5 pounds. During the following three minutes when no gas is being injected in any well, the discharge pressure builds back up to 730 pounds.

Without the volume reservoir on the discharge, it would take the compressor five minutes to inject the required 2239 standard cubic feet of gas. Under this condition, sluggish, inefficient gas lift would result.

Automatic speed and pressure controls are sometimes used in conjunction with gas lift compressors. This type of control reduces the compressor speed when a predetermined maximum pressure has been reached. If the pressure drops below this value, the compressor speed is increased. In this type operation, more compressor horsepower must be installed to take care of peak demands. The same job

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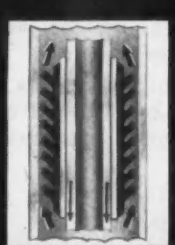
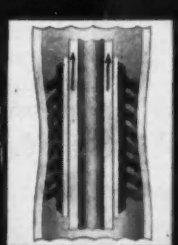
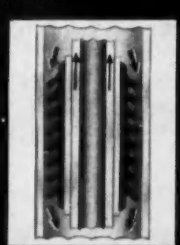


On the down stroke Fins are in normal upturned position, allowing E-Z Swab to fall free.

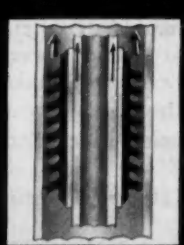
Flexibility of fins allows EZ Swab to pass smoothly through tight spots on up or down stroke.

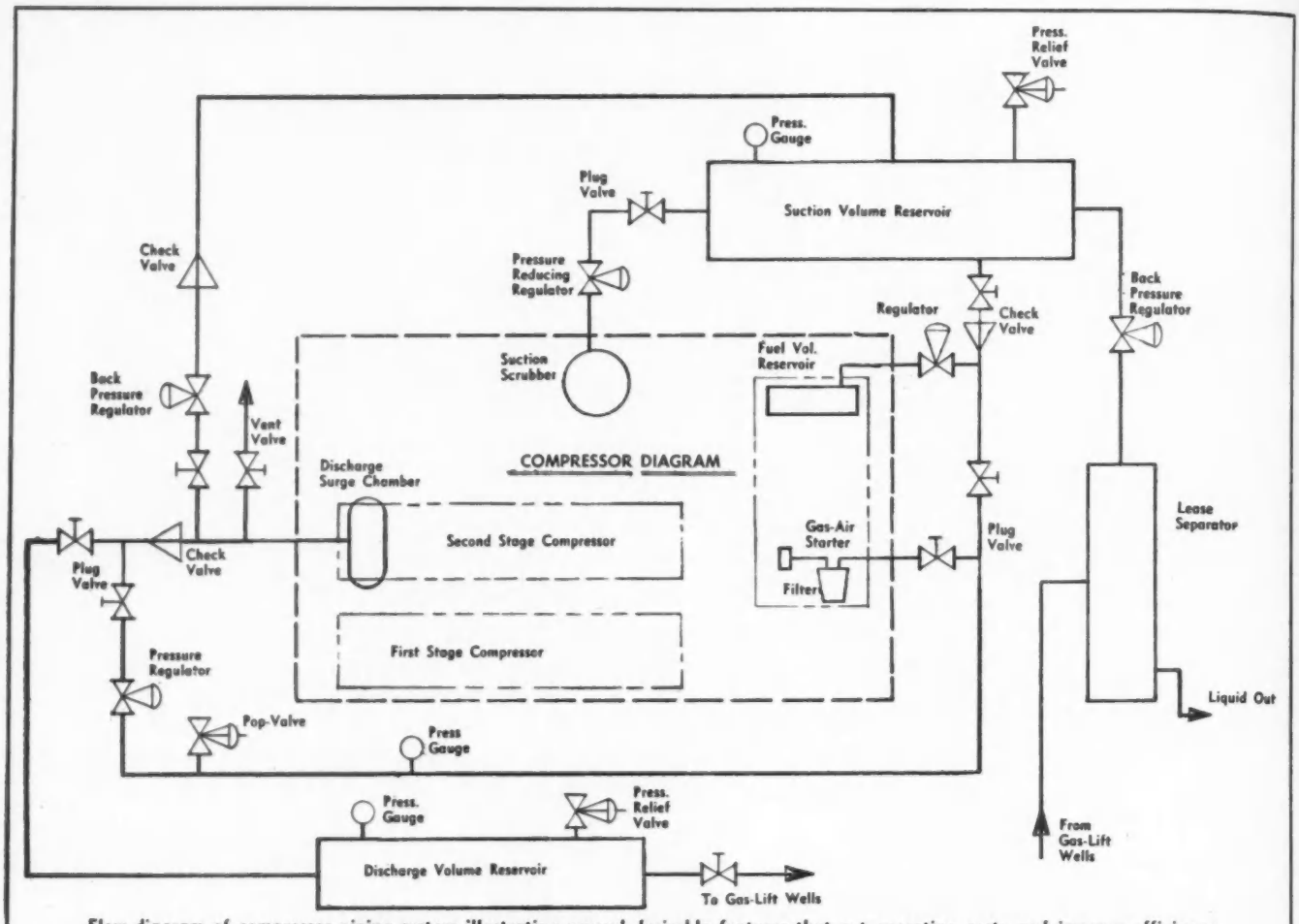




E-Z Swabs automatically by-pass fluid overload. Each rubber will lift approximately 400 feet of fluid. Rubber fins bend down and unload excess fluid.

After overload fluid is passed, fins spring up and seal against tubing.





Flow diagram of compressor piping system illustrating several desirable features that cut operating costs and improve efficiency.

can be accomplished as previously illustrated by the use of volume tanks on both the suction and discharge, and volume tanks cost much less than compressor horsepower.

In the eight-well gas lift lease previously described, if there had been no volume reservoirs, and the job was handled by speed and pressure controls, more than twice the horsepower would be needed to meet peak loads. With speed and pressure controls, the compressor would be working for two minutes, then idling for three minutes during every five minute period. In order to supply 2239 cubic feet of gas in two minutes, the compressor would have to put out 1120 standard cubic feet per minute. This job would require a 375-horsepower compressor. The 150-horsepower compressor can do the job at 448 standard cubic feet per minute with the use of volume reservoirs. The amount of gas that is not compressed during the idling periods of the controlled-speed compressor must be made up when the unit is running at rated speed. The horsepower needed to make it up in this case is the extra horsepower needed when using speed and pressure controls.

Should one of the wells in the eight-well gas lift system be shut in for any reason, the system need not be rescheduled. A back-pressure valve set to open at 770 pounds psi will pop excess gas back into the compressor suction through a bypass line to conserve gas.

Once the wells are operating normally again, the discharge pressure will fall to its original range and remain there. Reasons for this occurrence are (1) the compressor puts out less gas at the higher pressure, and (2) the intermitter allows more gas into the well at the higher pressure. Both tend to lower the pressure until it levels out.

After the gas is injected into the casing annulus, it passes through the gas lift valve and enters the tubing where it picks up fluid from the well. This fluid is carried on to the surface and to the separators where the gas is separated and flows back to the compressor suction. With 700 cubic feet volume reservoir on the suction (twice that of the discharge), theoretically there should be only about one half the pressure buildup, or 28¼ pounds. Actually, the pressure buildup will be appreciably less than one half because the gas does not return to the surface as fast as it is injected. Where two minutes were required to inject the gas, it may spread out over three or four minutes, and possibly more, in coming back. Where there are different types of wells on the system, they must be scheduled to smooth out the gas return.

A safety pressure relief valve usually is mounted on the suction reservoir chamber. It should be set to pop at 75 or 100 pounds. A back pressure regulator is included on the suction side of the system to vent gas at some pressure below the pressure relief valve setting in case of an emergency. When the compressor is shut down for an extended period, a valve on the downstream side of the discharge reservoir should be closed to prevent the loss of gas. Well intermitters will continue to function, draining the discharge reservoir. This gas is dumped into the separator which discharges into the suction reservoir. Once the pressure has been built up here, additional gas will be popped to the atmosphere and lost.

Because some clocks are fast and others slow, it is extremely difficult to synchronize intermitter clocks ex-

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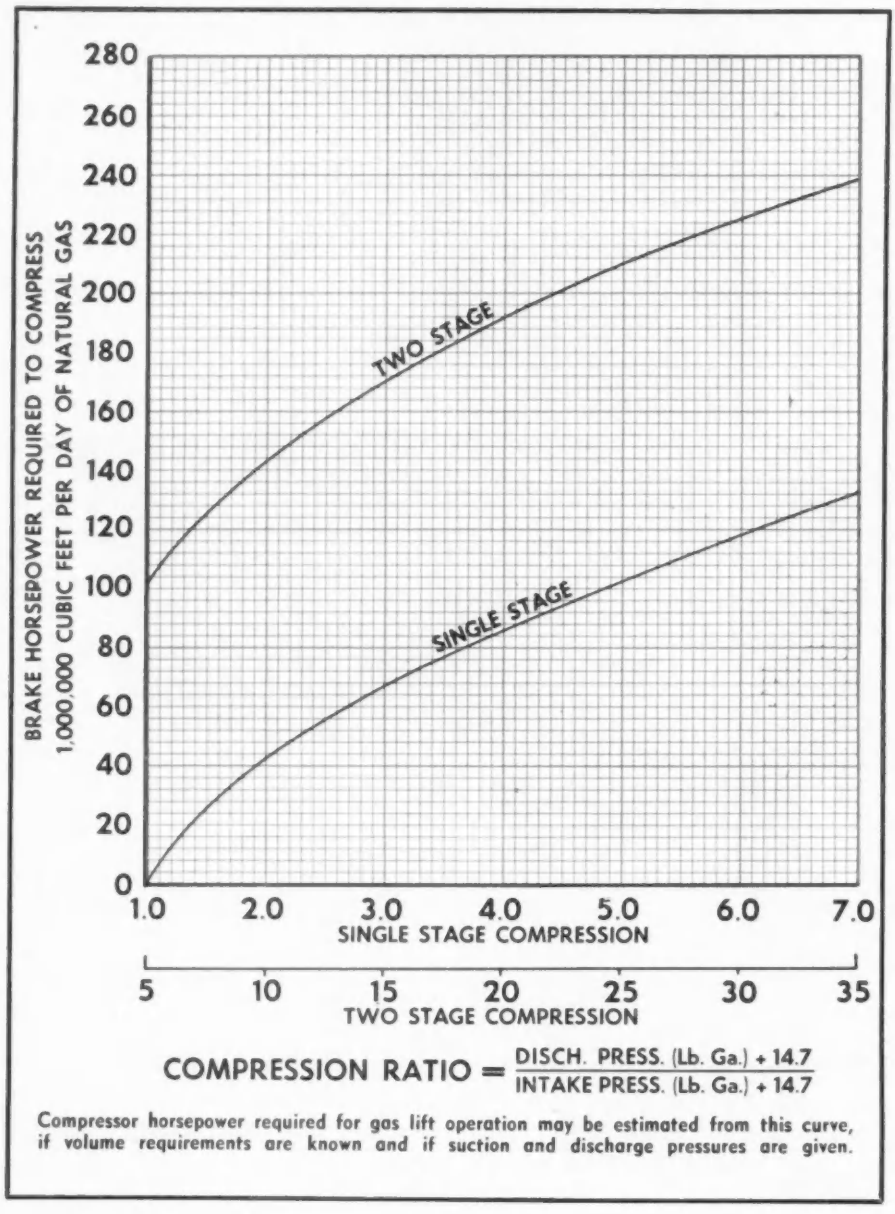

Compressor horsepower required for gas lift operation may be estimated from this curve, if volume requirements are known and if suction and discharge pressures are given.

exactly. It is desirable that two wells do not open at the same time. They can be scheduled to open at different times by juggling the wells in the schedule to find out which clocks are fast and which are slow. These intermitters can be reset when necessary. The volume reservoirs on both the discharge and suction will do much to keep the system operating efficiently should more than one well occasionally take gas at the same time.

Two sluggish wells should be timed so they will not open at the same time, for they will cause a delay in getting this bulk volume of gas back to the suction. In such wells there is considerable lag from the time gas is injected into the tubing until the slug of fluid reaches the separator and the gas released for recompression. The compressor will not perform at rated capacity when the suction pressure is below operating levels. A peak in suction pressure may be caused by two light wells intermitting one behind the other. In this case, the gas returns to the suction rather quickly. Such wells can be regulated by observation and proper timing.

Operating Pressures

Many gas lift systems initially use gas from high pressure gas wells for lifting purposes. Consideration should be given the operating pressures of gas lift valves put in these wells if they eventually will have to be lifted by compressed gas. The lowest operating pressure at which good results are obtained offers economies when compressors must be installed. Where there are high-pressure gas wells available, some operators are installing compressors and reserving the gas wells. It is good practice where such wells are available to tie in with the discharge system on the compressor so that the gas well will automatically cut into the discharge through a pressure-reducing regulator should the compressor be taken out of service.

Makeup Gas

If makeup gas is taken in on the suction side of the compressor, the proper regulator must be selected for the job. A one-inch regulator is usually sufficient for comparatively high pressures, however, a two-inch regulator or larger will be needed if the differential across it is small. Pilot-operated regulators are satisfactory for this service. If makeup gas is taken in on the high pressure side of the compressor, a one-inch pilot operated pressure-reducing regulator is usually adequate.

Gas for compressor engine fuel is taken off the suction so that only the volume of makeup gas necessary is let in the system. Some closed gas lift systems operate independently of any outside gas, and sometimes small amounts are vented. Where extremely high gas-oil ratio wells are lifted, and large volumes of formation gas are produced, it usually is profitable to market this excess gas. Small booster compressors may be used to step up the gas pressure to that required by transmission lines. At higher pressures, relatively large volumes can be moved with little horsepower.

Hydrate Freezing

It is difficult to predict the amount of hydrate freezing in a closed gas lift system. Some systems experience more hydrate freezing problems while others have practically none. Mechanical drips placed at strategic points throughout the line remove fluids before they reach freezing temperatures. In nearly every case, they will eliminate this difficulty. However, if the case is a severe one, methol alcohol injected into the discharge stream will prevent freezing. This has been done in the Gulf Coast for only $25 per winter. Injecting equipment costs about $90. Buried lines will cause liquids to drop out at about the same point in the line because the temperature variation is less than that on top of the soil.

Some cooling will be effected in the discharge reservoir, especially if an old well equipped with tubing is used, and where the gas goes into the tubing and out the casing, or vice versa. Final temperature will be about 250° F. Interstage gas is cooled back to about 130° F. Of course, these temperatures vary with atmospheric conditions.

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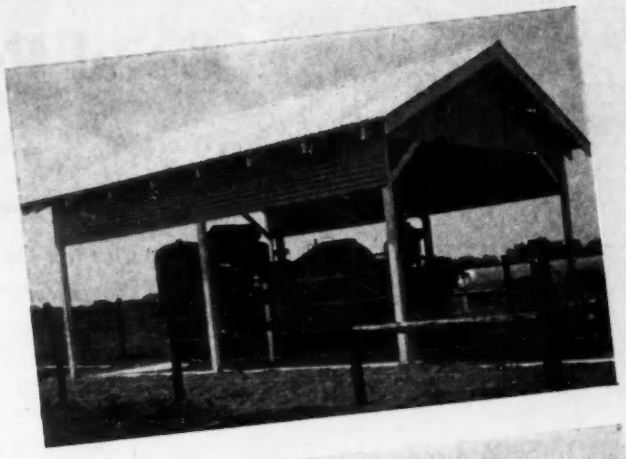

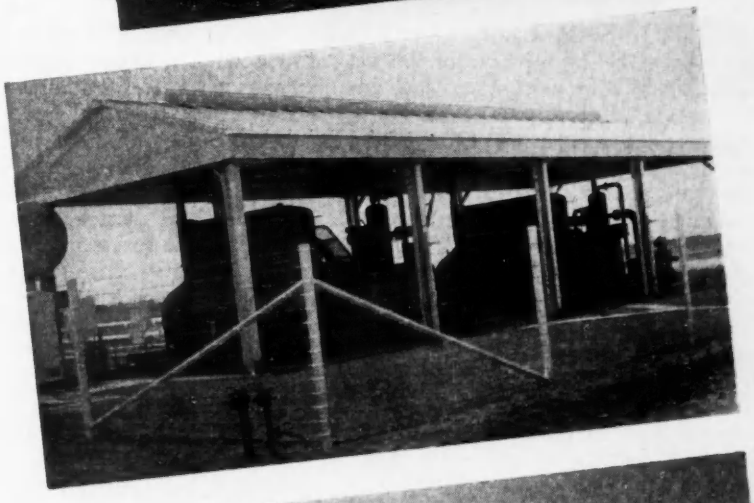

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Good Data Necessary For Good Reservoir Engineering

By JOHN A. MURPHY
Continental Oil Company
Ponca City, Okla.

ADDITIONAL profit and a better knowledge of an oil field's performance will inevitably result if management will provide adequate measuring facilities and field men will report production data accurately. Many important financial decisions of management are based on calculations which are no better than the data used in them. It is not sufficient to report "approximate" answers, such as estimating water cuts through use of the glass or thumb nail, or reporting gas production based on the size of flares. Answers can be just as wrong if the data are in error as where there are no data.

The most important measured basic data relative to the performance of reservoirs are the volumes of oil, gas and water being produced and pressure existing in the reservoir. It is desirable and important to know the relative volumes and physical and chemical relationships of oil, gas and water as they exist in the reservoir. However, this information is not always obtainable and frequently one has only the measurement of the volumes of liquids as they are gauged at the surface.

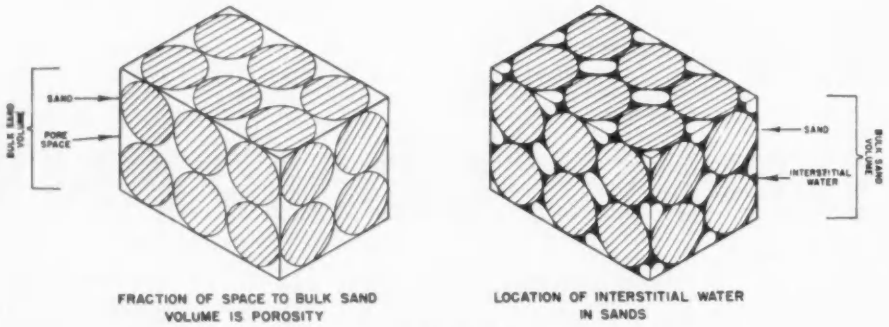
One of the most used (and also misused) theorems of reservoir engineering is the so-called "material balance equation." This states that oil, gas, and water produced from a reservoir plus the oil, gas, and water left in the reservoir are equal to the oil, gas, and water that originally existed in the reservoir. This is a very simple but a very important concept. You will note that three of the factors are the oil, gas and water produced and the *accuracy of these factors is the direct responsibility of field personnel.*

It is impossible to discuss adequately all of the uses for reliable field and well performance data. An attempt will be made to demonstrate the effect of field measurements on reservoir engineering calculations and the resultant decisions of management. First, it might be worthwhile to define several important terms used by engineers and geologists so that their tiein to field predictions will be better understood.

The two most important characteristics of reservoir rocks are porosity and permeability. Porosity is simply the fraction of void space in the reservoir rock that is capable of containing oil, gas or water. If one-tenth of the rock volume consists of pores or "vacant spaces" the rock has a porosity of 10 percent. Most sand reservoirs have from 12 to 25 percent porosity although some may be as low as 5 percent or as high as 40 percent. Limestone porosity usually ranges between 2 and 20 percent. Permeability is defined as the ability of a porous material to transmit fluids, and is a unique property of the size and distribution of the pores.

In 1856 Darcy noted that the velocity of fluids flowing through sand was proportional to the pressure across the sand and inversely proportional to the viscosity of the fluid; the standard unit of permeability measurement has since been named the Darcy. This unit is too large to describe the permeability of most reservoirs, and the term "millidarcy," or one thousandth of a Darcy, is used for simplicity. If a sand has one Darcy (or 1000 millidarcys) permeability, one square foot of sand one foot thick would pass approximately one barrel of oil per day with only a pound pressure drop. Most commercial oil reservoirs have permeabilities in the range of from 50 to 500 millidarcys, although some fields produce commercial quantities of oil or gas when the permeability is less than 10 millidarcys. Permeability may be infinitely large in the case of large cracks, fractures, or channels in the reservoir rock. Sometimes zones of very low permeability are traversed with fractures which provide wells with very high potentials, although this is in no way indicative of high ultimate recoveries.

Another factor of importance is



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LOCATION OF INTERSTITIAL WATER IN SANDS

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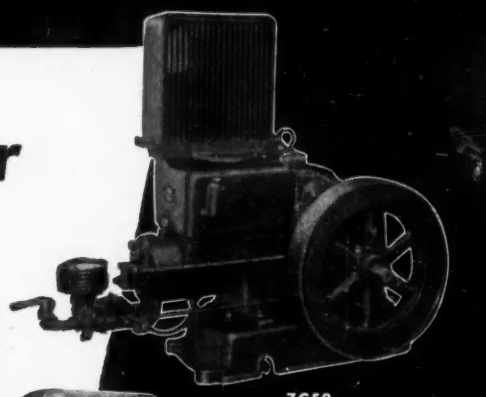

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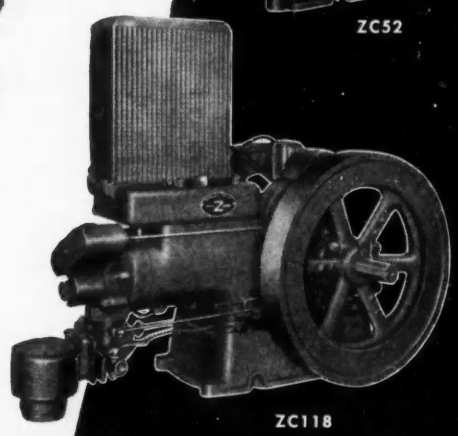

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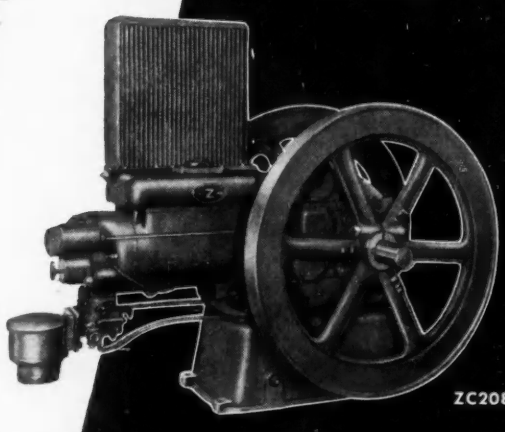

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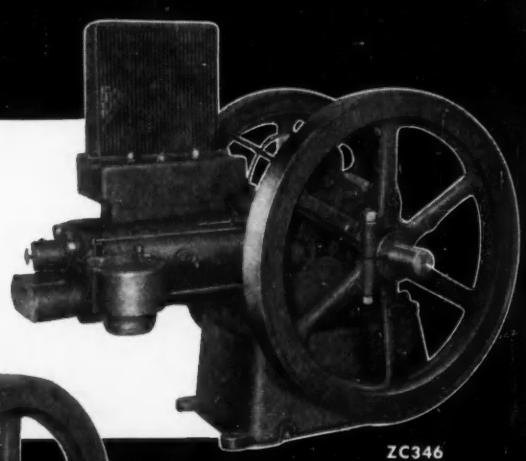

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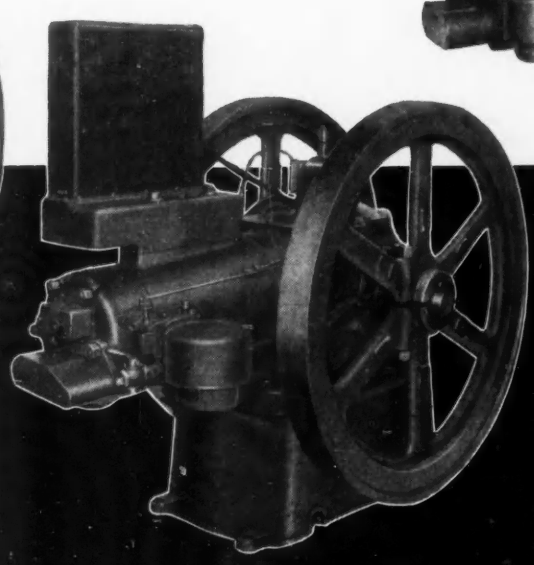

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the so-called "connate" or "interstitial" water content of the rocks. Either of the terms may be used although technically connate water refers to the water laid down at the same time as the reservoir rock and interstitial water is the water found in the pores of the reservoir rock when it is first drilled for oil or gas. Interstitial water is important because it decreases the amount of pore space available for oil or gas.

This water seldom is produced by wells as it fills the angular spaces at the contacts of the sand grains and usually cannot be displaced under normal producing conditions. It has been found that a relationship exists between the interstitial water content and the permeability of the rock; the "tighter" or the lower the permeability of the rock, the greater the water saturation, expressed as a percentage of the pore volume. The usual range of water saturation in commercial oil or gas reservoirs is from 15 to 35 percent. Some commercial oil sands are known to contain up to 60 percent water, but these are exceptional; generally, if the water saturation exceeds 45 percent of the pore space, water will be produced with the oil or gas.

Certain measurable characteristics of the reservoir fluids are important to an understanding of the behavior of oil and gas reservoirs. Perhaps the most important characteristic is the ability of the oil to contain dissolved gas. This phenomenon is similar to bottled pop containing carbon dioxide. Gas comes out of solution from the oil whenever the pressure on the oil is lowered below the so-called "bubble point pressure." For example, if 500 cubic feet of gas are in solution in the oil, the gas will come out of the oil only when the pressure is reduced below about 1500 pounds per square inch.

This would be called the "bubble point pressure," and the amount of gas dissolved in the oil would be the "solution gas-oil ratio." Frequently the original reservoir pressure is above the bubble point pressure which means that no gas comes out of solution from the oil in the reservoir until the bubble point pressure is reached. Many reservoirs have a "solution gas-oil ratio" of only 5 to 100 cubic feet per barrel of oil whereas the oil could contain 300 to 800 cubic feet of gas per barrel at the original reservoir pressure. This type reservoir would be called "undersaturated" as the oil does not contain all of the gas which could be dissolved in the oil.

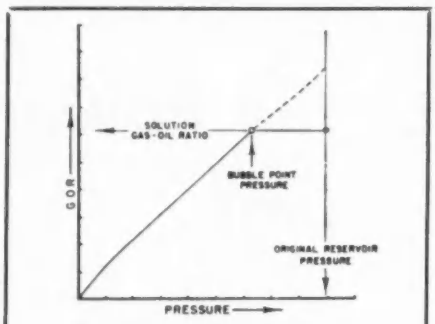


CHART SHOWING RELATIONSHIP OF SOLUTION GAS-OIL RATIO TO RESERVOIR PRESSURE

FIGURE 2.

The solution gas-oil ratio is a critical factor in determining the amount of oil that can be produced from a reservoir because the compressed gas may be the only source of energy available to drive the oil to the well bore. Oil expands in volume when gas is dissolved in it. Each barrel of tank oil, containing no dissolved gas, occupies something greater than one barrel of space in the reservoir where it contained dissolved gas.

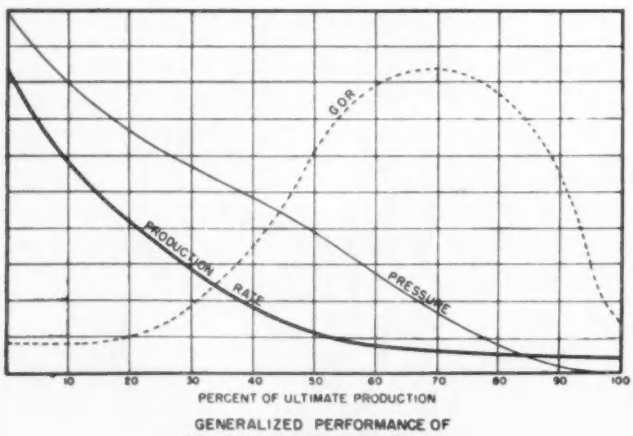
The number of barrels of reservoir space occupied by one barrel of tank oil is called the "formation volume factor." For example, it was mentioned that at 1500 pounds pressure a certain oil could contain 500 cubic feet of dissolved gas. As a result, a barrel of stock tank oil would occupy about 1.3 barrels of space in the reservoir. As gas comes out of solution from the oil the oil "shrinks" or occupies less volume. The "shrinkage factor" is merely the percentage reduction in volume of a barrel of reservoir oil as the solution gas is removed from it. Shrinkage factor and formation volume factor express the same idea, but are stated in different ways.

Producing Mechanisms

There are certain other characteristics inherent to any reservoir which may control to a great extent their development and operation. These are the "driving" or "producing" mechanisms by which the oil and gas are brought to the well bore. There are three general classifications of producing mechanisms—solution drive, gas cap drive and water drive. Many reservoirs will have a combination of two or more of these producing mechanisms. Actually there is a fourth type, gravity drainage; which, although it may be important, is not in the true sense a type of drive. Almost all reservoirs will produce some oil as a benefit from gravity drainage.

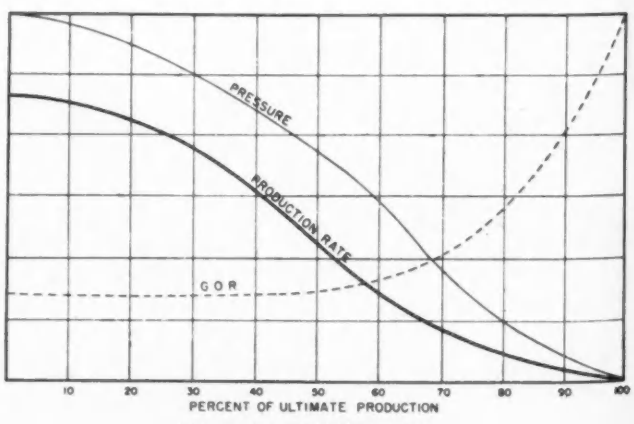
The "solution gas drive" also referred to as the "depletion" type or "internal gas expansion" type is the most common producing mechanism. This type drive means that the energy causing the oil to flow to the well bore is derived only from the gas which is in solution in the oil. As mentioned before, oils may hold large quantities of gas in solution at reservoir pressures and as the pressure is reduced in the reservoir, this gas comes out of solution and expands, causing oil to be driven to the well bore.

When the well is opened to production, there is a pressure drop in the sand surrounding the well and the oil and gas just naturally migrate to the



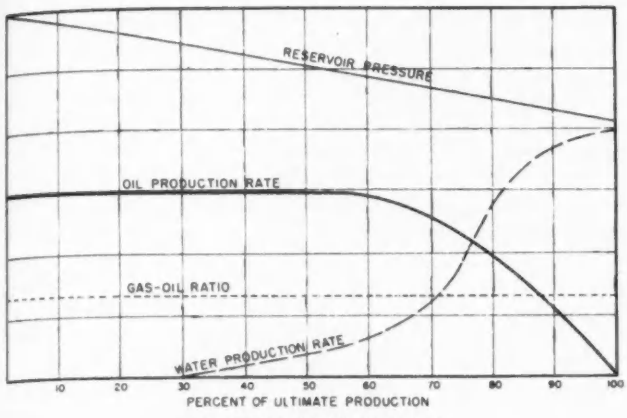
GENERALIZED PERFORMANCE OF SOLUTION GAS DRIVE RESERVOIRS

FIGURE 3



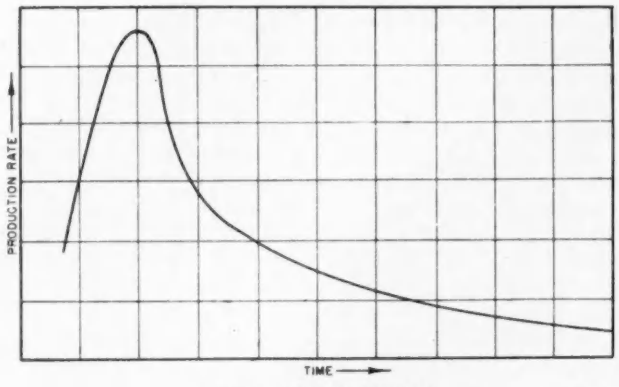
GENERALIZED PERFORMANCE OF GAS CAP DRIVE RESERVOIRS

FIGURE 4.



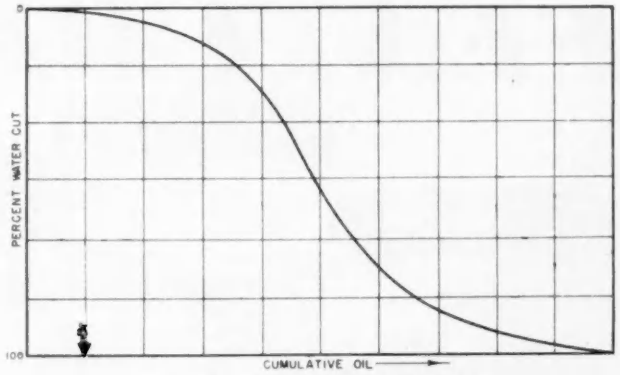
GENERALIZED PERFORMANCE OF WATER DRIVE RESERVOIRS

FIGURE 5.



DECLINE CURVE OF SOLUTION GAS DRIVE RESERVOIRS

FIGURE 6.



WATER CUT PERFORMANCE FOR BOTTOM OR EDGEWATER DRIVE RESERVOIRS

FIGURE 7.

well, the point of lowest pressure. A solution gas drive reservoir generally produces the least percent of the original reservoir oil of all the three major drives. Recoveries range in the order of 15 to 30 percent depending on the amount of gas in solution, the permeability of the formation, and the viscosity of the oil. There is considerable debate at the present time as to whether well spacing is a major item in the percent recovery to be obtained from solution gas drive pools.

A reasonable production history for a solution gas drive pool is shown in Figure 3.

Production is characterized by a continuous drop in reservoir pressure and production rate and an increase in gas-oil ratio. Potentials of wells drop off very rapidly but gradually level off to something approaching a 10 to 20 percent decline in production per year. The gas-oil ratios may increase to approximately 6 to 10 times the original producing gas-oil ratios. Bottom-hole pressures decline rapidly and in general about 50 percent of the reservoir pressure is dissipated when the pool has produced 30 to 40 percent of its ultimate oil recovery.

It is important to have accurate field data early in the life of fields of this type. Gas-oil ratios, especially on initial potential tests and shortly thereafter, are essential to the proper programming of field development and the estimation of reserves of oil and gas. Preliminary plans may be made by the management to build a gasoline plant or gas compressing facilities on the basis of early gas-oil ratio data and erroneous data can lead to misspent dollars. *In solution gas drive fields it is impossible to repeat original producing conditions; from the date of first production, wells are on the decline.*

A second type drive, the "gas cap" or external gas drive reservoir exists where the oil is in direct contact with "free gas" or gas that exists in the gaseous phase in the reservoir. Gas cap drive reservoirs produce a greater percent of the oil than do the solution gas drive reservoirs due to the additional energy of the free gas. Recoveries may range from 25 to 75 percent depending to a great extent on the amount of free gas present. The characteristic performance is shown in Figure 4.

Well potentials decline from date of first production but not as rapidly as wells producing from the solution gas drive reservoirs. Gas-oil ratios may remain fairly low during a considerable portion of the pool's life; when they start up they continue to climb until most of the field production is gas. Of course, there are all sorts of combinations of solution gas drive and gas cap drives possible as the former is usually present in a gas cap drive reservoir.

Water drive pools generally are considered to be the most productive in terms of percent recovery of the original oil. It is not uncommon to have recoveries in the order of from 40 to 80 percent of the original oil depending on the location of the water and the structural features of the reservoir. Water may enter a reservoir from the edge, in which case it is in contact with only a small areal portion of the reservoir fluid. As the pool is depleted, the water moves horizontally to the producing wells, flushing the oil along the bedding planes.

If the permeability of the sand is somewhat constant from top to bottom and the sand is not thick, this type of drive is very efficient and a high ultimate recovery is obtained. If the sand contains some streaks of high permeability, the water may force the oil through these streaks and prematurely reach the well bore. In this case only a small portion of the sand is swept of oil and the water drive becomes inefficient. Remedial work may result in shutting off the watered-out streaks, giving the tighter sands a chance to produce.

Different from the edge water drive is the bottom water drive, wherein the oil zone is underlain by a "table" of water. If the oil saturated section is thin, say from 4 to 10 feet, considerable care has to be exercised in production practice to prevent "coning" of the water into the well. Otherwise the water may move upward to the well before the oil can move horizontally to the well, thus resulting in premature "watering out" of the production. Where a thick zone of oil occurs above a water table and no

barrier exists to restrict vertical movement of the water, the percent oil recovery may be high.

The production performance of water drive reservoirs is characterized by little drop in well potential and reservoir pressure or increase in gas-oil ratio until such time as water cuts are noted. As water production increases the potentials of the wells will decrease although reservoir pressure and gas-oil ratios may remain constant. Typical performance of water drive pools will be as shown in Fig. 5.

The foregoing discussion has been primarily concerned with reservoir factors and general performance. Obviously it is impossible to describe all the variations in average reservoir performance and it can always be assumed that no reservoir will be the typical example but some modification of several types.

Before the engineer can describe the producing mechanisms of a reservoir it is necessary that he have some historical data in the form of pressure and production measurements. *This is where the cooperation of the field man is required and his reliability is a direct factor in the accuracy of the engineering calculations.*

First measurement of the ability of a well to produce is the "initial potential" at which time the oil and gas rates and the surface pressures are recorded. In "depletion" or "solution gas" drive reservoirs this test can never be duplicated and represents, under the proper test conditions, the relationship of the oil and gas under original reservoir conditions. Engineers may often have to correlate laboratory data with the "initial potential" in order to establish the validity of the laboratory measurements.

The gas-oil ratio for the reservoir and many predictions of gas production are based on this measurement. Ultimate oil production is a function of the solution gas-oil ratio and thus the original estimates of recoverable oil are tied in to the "initial potential" data. The degree of permeability of the formation and the areal distribution of permeability are often determined from well potentials, and erroneous data may lead to misplaced wells, either for production or injection purposes. It is not sufficient to report accurately only the oil and gas production but also the water produc-

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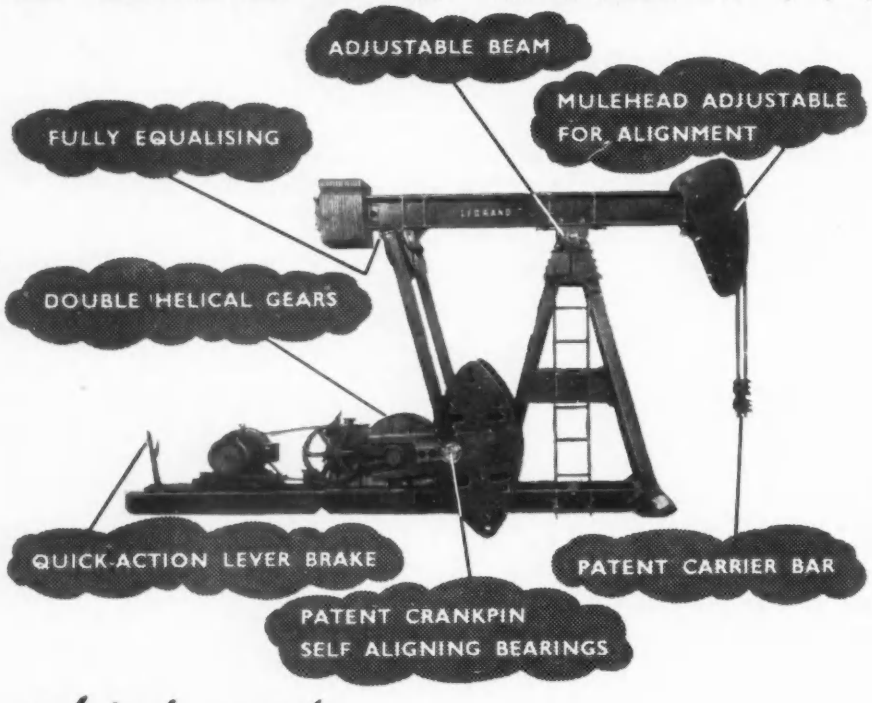

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About the Author

JOHN A. MURPHY is chief reservoir engineer of Continental Oil Company at Ponca City, Okla. He started with Hilldon Oil Company in 1937 at Long Beach, Calif., where he worked during summer months. He was graduated by the University of California in 1942 with a degree in petroleum engineering and joined Tide Water Associated Oil Company at Kern River as roustabout. He later became a production engineer at Santa Fe Springs. In 1945, he moved to Midland, Texas, to work for Phillips Petroleum Company as division reservoir engineer. In 1948 he went to Ponca City to work in Continental's newly-organized development and research department. He helped establish its reservoir engineering section.

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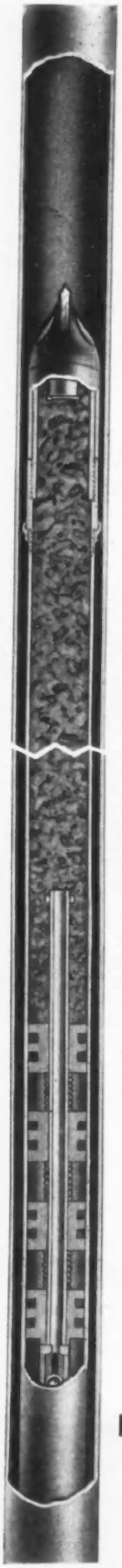

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tion. Water produced on initial potential tests may be one of the few clues as to the water saturation in the sands or the proximity of a water table.

A small and stable water cut may indicate that the water saturation in the sand is sufficient to allow a small amount to flow through the sand. Water cuts which vary with flow rates may indicate the presence of bottom water or zones of high water saturation. *Not reporting water on the I. P. or not reporting it accurately can lead to misconceived ideas about the reservoir and subsequent plans for developing the reserves.*

Continued accurate measurements of the oil production are required for payment of royalty and oil sales. The engineer makes good use of the oil production data as far as lease production is concerned and with various methods for graphing production data can determine to a fair degree the reserves of oil and the performance of the pool but for many purposes the least production data are not much help. Well data or at least production data by individual sands are required.

A common method for utilizing oil production is to plot monthly oil production against time or against cumulative oil. Naturally if the production is prorated the oil rate will have little meaning. However, if well potential tests are available periodically, these potentials can be plotted on similar graphs to obtain a reasonable idea of the reservoir performance. A typical "decline" curve is shown in Figure 6.

Gas Production

Gas production, a seriously neglected item, is essential to an understanding of the reservoir performance. Especially is this true early in the life of all reservoirs and continuing throughout the life of solution gas or gas cap drive reservoirs. Naturally it is difficult to show a payout on the time and expense necessary to measure gas if no gas is sold and such expenditures must be made solely to provide the proper data for evaluation of reservoir performance.

In "solution gas" reservoirs the gas-oil ratio is a function of the state of depletion of the reservoir and a better prediction of reserves can be made if the gas-oil ratio history is known. In all material balance calculations the total volume of production must be known and the gas is a critical item in the volume of production.

Perhaps the gas reserve indicated from the reported gas data is sufficient to support a gasoline plant or indicate that a gas injection program is necessary. Obviously it is necessary that the gas data be accurate before such installations are made. The presence or absence of gas caps is often discovered only by an examination of the gas-oil ratio history. Assume for instance that the gas-oil ratio decreased sharply during the early life of the pool; this would indicate depletion of a gas cap or gas sand.

Some minor decrease in gas-oil ratio can be expected early in most fields. If the gas-oil ratio increases above that ratio which may be normal for

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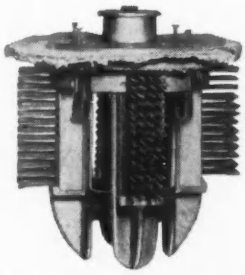

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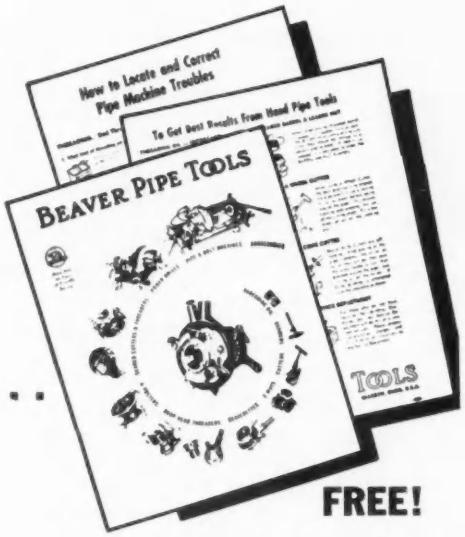

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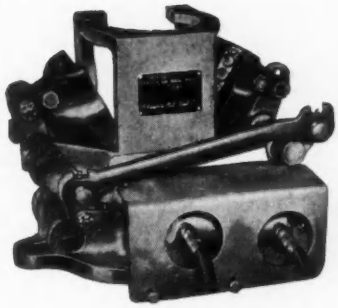

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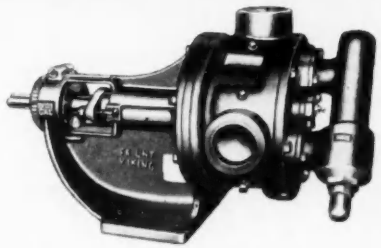

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the type of drive, a coning of gas cap gas into the well may be indicated. There is evidence that gas-oil ratio may be a function of the well production rate—that is, at too high or too low a production rate the ratio may be excessive, but at the optimum rate the ratio is a minimum. This condition probably exists only in reservoirs where there are sand streaks of high and low permeability.

Without gas measurements many of the above conditions would go unnoticed and perhaps the maximum amount of oil would not be obtained from the reservoir. Without accurate data on gas production the engineer's knowledge of the reservoir is too limited to allow him to provide management with proper recommendations on reservoir control.

Reservoir Water

Reservoir water is an item which is unsaleable and thus its accurate measurement is frequently ignored. Water, however, is one of the liquids existing in the reservoir and a knowledge of its behavior is essential for understanding reservoir performance. In water drive reservoirs the water production data may be the only factor indicating the reservoir control. A small amount of water produced at a constant rate may indicate that the water saturation of the sand is high enough to allow some flow; it may also indicate a small zone of water which contributes to the well a constant rate.

If the water is a result of high water saturation in the oil sand it will quite often disappear whereas a water zone may continue to produce. A sudden influx of water can be the result of an edge water drive reaching the well or of water breaking into the well through a water sand as a result of a hole in the pipe or faulty cement job. The general case in a water drive field is where the water increases gradually from 0 to 100 percent. This is characterized by an S shaped curve when percent of water is plotted against cumulative oil production. For an example see Figure 7.

The curve may be characteristic of both bottom water drive and edge water drive fields. Water entry into a well can be costly, both from loss of recoverable oil and expense of lifting the water. Many approaches are used to control the water. However, it is first necessary to know where the water comes from, and in many cases a knowledge of the water producing history is the only clue to its entry. Bottom water production can be detected if the percent of water produced varies with the rate of flow of the oil. The higher the production rate the higher the water cut and if the oil rate is sufficiently reduced no water may be produced. This water is a result of "coning" as the water theoretically has the shape of a cone reaching up from the water table with the peak at the bottom of the well.

As the water table moves upward the oil production rate at which no water is produced decreases and eventually the well must be plugged back. An accurate knowledge of the water cut history of a well is necessary before the proper remedial work can be accomplished. *There are many cases on record where a better idea of the reservoir could be obtained and more successful reconditioning jobs could be accomplished if a continuous and accurate record of water production were available.*

ACKNOWLEDGMENT

This paper was presented at the spring meeting of the Pacific Coast District, API Division of Production, May 15, at Los Angeles.

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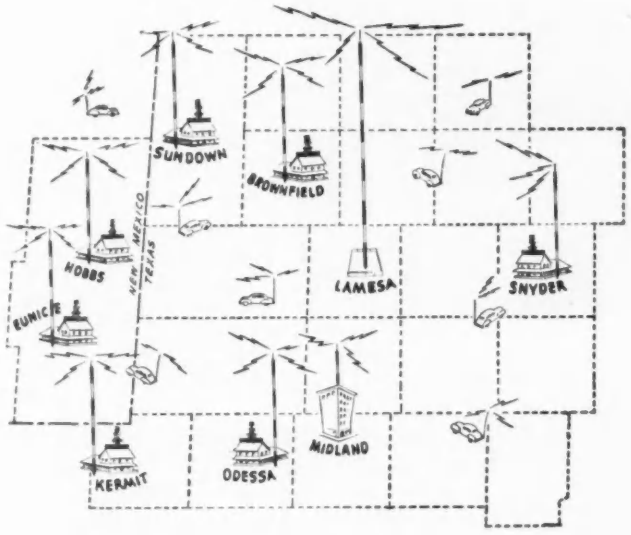

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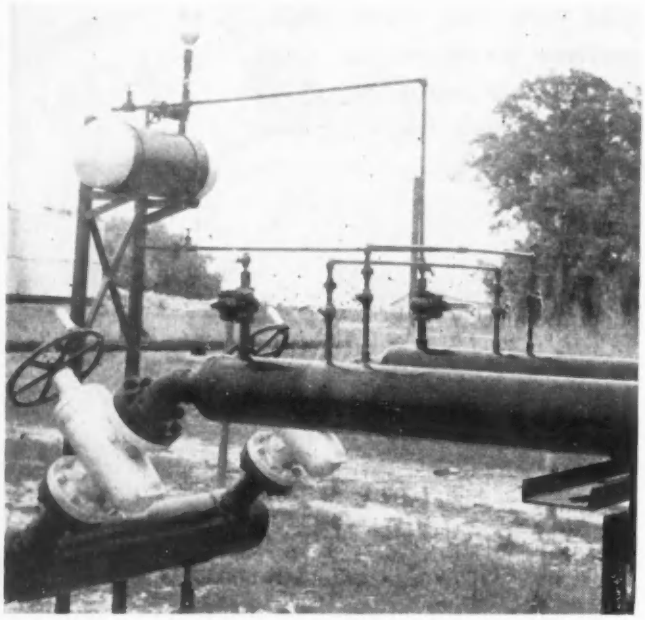
Alcohol Injection Stops Hydrate Freeze

Injection of small amounts of methol alcohol into the gas stream during winter months eliminated the old problem of hydrate formation immediately downstream of the orifice plate in the meter run. If allowed to continue unchecked, this formation would plug up the line and it had to be thawed out before gas would flow through it again.



This simple yet effective injection system at a meter station which supplies gas to a transmission system has saved considerable shutdown time to thaw either of dual meter runs. High-pressure field gas at about 800 pounds is piped to the manifold shown at left in picture. Two dual meter runs are connected into this manifold through two elevated gate valves.

A 15-gallon, high-pressure vessel containing the methol alcohol was mounted on two pipe supports as shown. Connected into the vessel are a fill line, a pressure equalizing line and an injection line off the bottom. Upon filling the vessel with alcohol, the equalizing valve and injection line valve are closed and pressure bled from the vessel through the fill line. Then the chamber is filled, and the fill valve closed tightly. The equalizing line is opened and the vessel pressured up to line pressure. The injection line is opened slightly to allow small amounts of alcohol to flow into the dual meter runs.

Two taps have been made on each meter run; one tap for the equalizing line, the other for the alcohol injection line. There is an equalizing header and injection line header that connect above the meter runs and tie in with a single line to the supply vessel. Alcohol gravitates into the flow stream and acts as an anti-freeze to prevent small amounts of water present in the stream from freezing due to the pressure drop across the orifice. Injection is not required in the summer months.

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A two-inch screwed flange was bolted to the bottom of this 500-barrel stock tank in a battery of six tanks in two rows of three tanks each. A short nipple, a plug valve, a second nipple, an ell, a closed nipple and a second ell complete the drain

assembly illustrated. Purpose of the double ell design is to permit the pumper to raise or lower the spout to determine when most of the sediments have drained out so that little oil will be lost.

The drain in this installation is a buried four-inch line leading up to each tank. Extending the full length of the battery between the two rows of tanks is a drain header that leads to the burning pit. Each four-inch drain connects into this header below ground. In this manner, water and sediments from all tanks can be disposed of quickly and neatly.

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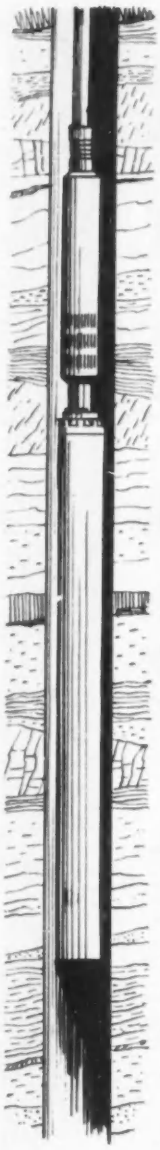

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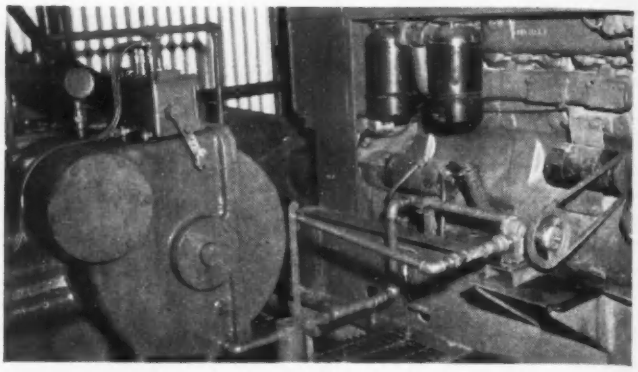
Novel System Lubricates Pump

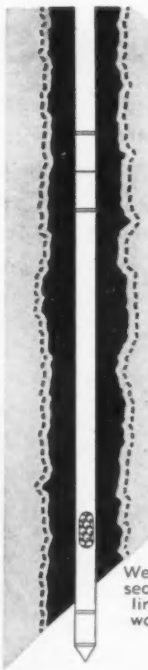


A small gear pump driven off the generator of the prime mover circulates lubricating oil in a high-pressure, triplex pump to insure proper oiling when required. Both pump and engine are unitized on a common I-beam skid, and are used in well servicing work.

It is essential that the gear train at either end of the pump's power shaft be flooded with lubricating oil while the pump is in operation. To supply adequate volumes of oil to both gear units, a small gear pump was installed on the 110-horsepower engine to circulate oil from the bottom of the gear case back up to the top of the gear train.

The gear pump is shown at right mounted on a pedestal welded to the engine skid. It is equipped with a V-belt which is powered by a sheave added to the generator shaft of the engine. The pump takes suction from the bottom of the pump's gear box through ¾-inch pipe. Discharge from the pump is also through ¾-inch pipe into a 3-inch manifold supported atop the power end of the pump. Each end of the lubricating oil manifold is connected through 1½-inch unions to the pump. Oil is discharged into the manifold and distributed to the gear trains on either side of the pump where the oil pours over the gears.

There are two particularly noteworthy features about this hookup. Oil will always be supplied the gears of the pump so long as the prime mover is operating. Power required to circulate the oil is taken from the engine at little cost. Another desirable feature from an operating standpoint is the location of all parts. They are accessible for inspection and repair.



Well bore cross section. Dotted lines indicate wall reaming.

Clean Out Congested Wells

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Cross section view of torpedo

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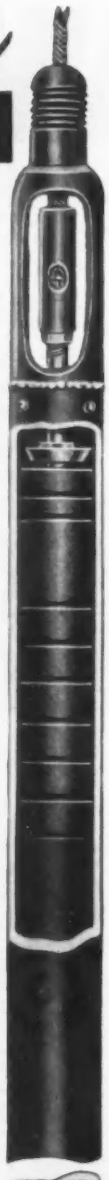

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3½"
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Chisel Bottom Illustrated

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PRODUCTION HINTS

Riser Serves as Support

A vertical riser in a high-pressure gas line may be used to support one end of the pressure regulation assembly and blowoff valve. Gas from a high-pressure well is first heated before taking a reduction in pressure by the regulator shown in this installation to prevent formation of hydrates that may clog the flow line. The gas at this reduced pressure is then placed in a 4-inch gathering system. Extending out of the ground for about three feet is the beginning of the 4-inch line taking gas from this particular well. Its vertical position has been used to ad-advantage as a support for the assemblage of controls and bypasses required by this high-pressure installation.

Inlet line into the pressure regulator was reduced to 2-inch, with two plug valves located on either side of the regulator. A swedge nipple connected the vertical riser with the downstream block valve. The conventional bypass was included, and was hung below the regulator. It also was attached to the vertical riser which supported the bypass line and valve.

A 1½-inch coupling welded to the 4-inch riser about 18 inches above ground provides a connection that supplies the heater with fuel. At right angles around the riser from this col-

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water cans and coolers
GOTKOOL WATER CAN
Made in 1½, 2, 3, 5, 10, 15 and 20 gallon sizes. Push-Button Faucet at slight additional cost.
GOTKOOL WATER COOLER
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KEEP PURE DRINKING WATER ALWAYS HANDY
GOTT Water Coolers are the convenient way to keep drinking water handy to the worker, protect it from impurities. Their exclusive construction keeps water cool for long periods. Snug-fitting, large, removable top, handy non-leaking push-button faucet. GOTT Water Cans for handy field use. Your supply store has them, get one today!
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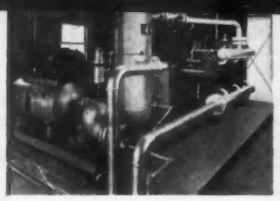
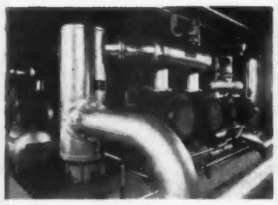
8 JVG in East Texas



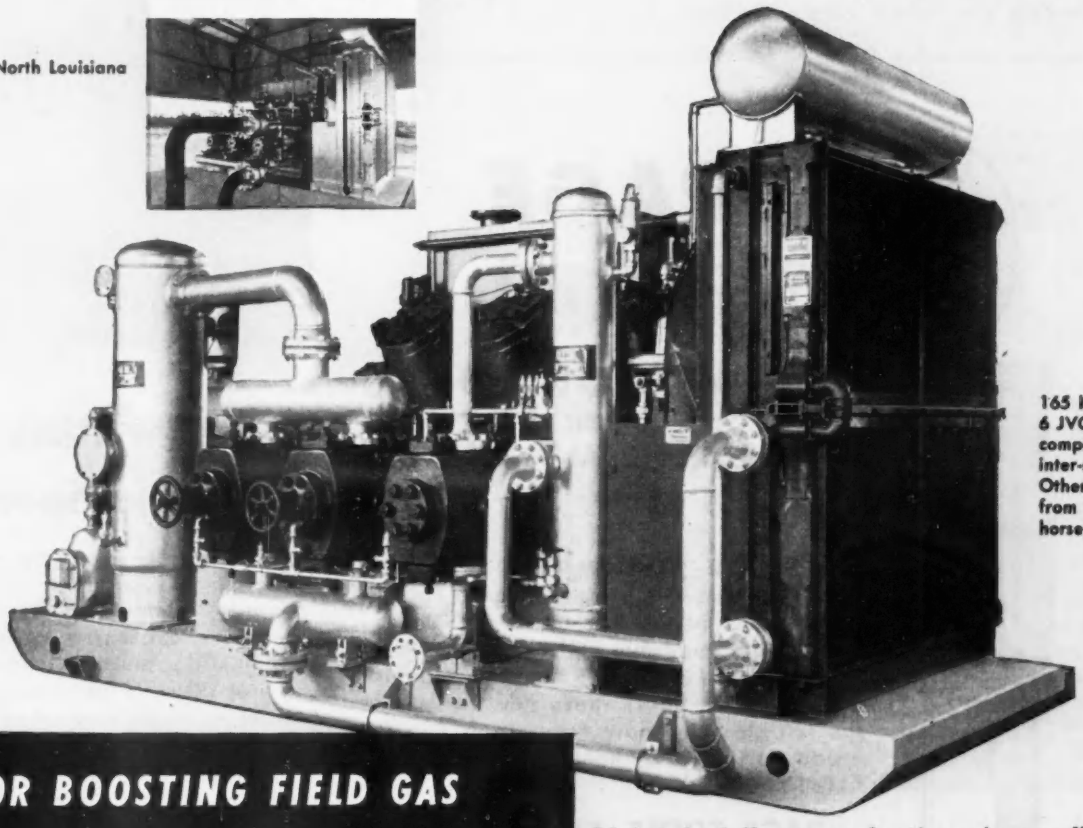
8 SVG in Texas Panhandle



6 JVG in North Louisiana

BEAIRD Ingersoll-Rand

PACKAGED COMPRESSOR PLANT



165 horsepower 6 JVG with two-stage compression and inter-stage gas cooling. Other sizes available from 110 to 550 horsepower.

FOR BOOSTING FIELD GAS

Maintain full gas production when well head pressures drop, with a Beaird Ingersoll-Rand packaged compressor plant.

Low cost per horsepower, installed, makes this packaged compressor the most economical means of boosting your field gas to gathering line pressures.

LOW COST INSTALLATION — complete packaging and full assembly in the factory save on installation costs.

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NO ATTENDANT NECESSARY — automatic controls stand watch over operation; only routine maintenance required.

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THE J. B. BEAIRD COMPANY, INC. SHREVEPORT, LOUISIANA

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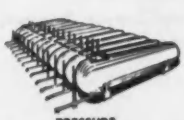
ANHYDROUS AMMONIA EQUIPMENT



PRESSURE BULK STORAGE

SINCE 1918 BEAIRD SHREVEPORT

LOWEST COST PER HORSEPOWER, INSTALLE

lar is a 1-inch collar which supplies gas pressure to power a chemical injection pump. This 1-inch line connects into a scrubber made from a short section of 2½-inch pipe. This scrubber is supported by a bracket welded to the swedge nipple on the flow line entering the 4-inch riser. Only one additional support, an adjustable one below the bypass line in the background, is required to install the complete regulator assembly. The 4-inch riser was topped with a blow down plug valve and pressure relief valve which opens at some preset pressure.

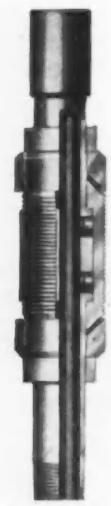
Muffler Puts Out Engine Sparks

Sparks or backfire from an engine powering a well pulling unit are extinguished before they are given a chance to cause a fire by a small combination muffler, weather-proof exhaust cover. This precaution is essential in working on oil or gas wells where there always exists a potential fire hazard.

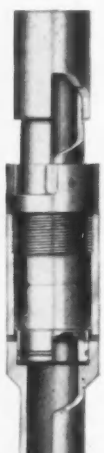
Made in the shop from galvanized iron sheeting of about 12- or 14-gauge plate, the muffler measures only about 10 inches long, 8 inches wide and perhaps 15 inches high. A four-inch collar was welded into the bottom so that half of the collar extended into the inside compartment.

Near the top, short nipples of four-inch pipe were welded horizontally into the side walls as shown so that a lip extends inside. A two-inch collar and plug were added at the bottom so that any condensation occurring inside the muffler could be drained.

The unit is screwed onto a vertical four-inch riser from the engine exhaust manifold. Because of the enlarged volume of the muffler and since the two horizontal openings are considerably larger in area than the four-inch diameter exhaust pipe, there is a sudden expansion inside the muffler. Any sparks are trapped and extinguished. While the muffler is not designed primarily as a noise-reducer, it does cut out some of the exhaust blasts.


Type "B" Tubing Anchor

Type "C" Tubing Anchor


Tubing Drain

On & Off Attachment

PAGE TENSION TOOLS

PAGE

TENSION TYPE

PRODUCTION TOOLS
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D + B and CONTINENTAL SUPPLY STORES

PAGE "TENSION TYPE" Production Tools—Tubing Anchors, Tubing Drains, and Sucker Rod On & Off Attachments—are available in the Mid-Continent through your nearest D+B and Continental Supply Stores. Check these new Tools. Get the *full* story on how *Page* Tools can cut production costs by keeping tubing in the hole longer!

PAGE TOOLS ARE *different*

TYPE "B" ANCHOR for ROD PUMP STRINGS: Page Type "B" Tubing Anchors set hydrostatically as the well pumps up!

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FIELD RECORDS PROVE . . .

. . . that anchoring the Page Way *increases* pump efficiency and *decreases* equipment wear —visit your nearest D+B Pump Store or Continental Supply Store – find out how Page "Tension Type" Tools can help *you!*

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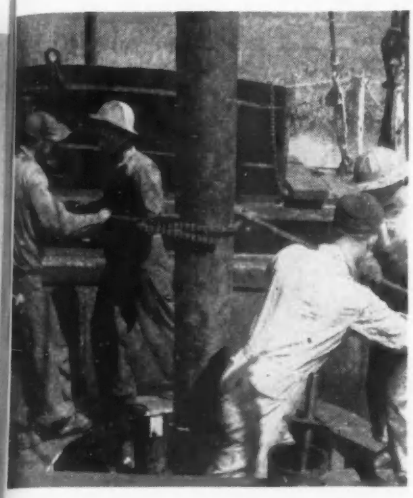


Back Pressure Valve Saves Gas

Maintaining a constant back pressure on the lease separator will insure adequate gas pressure to operate dump valves and other control devices. Should the pressure in the separator drop to below 15 or 20 pounds, there is not sufficient pressure to cause the dump valve to function, and the separator may overflow into the gas line.

In fields where development wells are drilled with steam rigs, or several gas-fueled rigs running where several million cubic feet of gas per day are

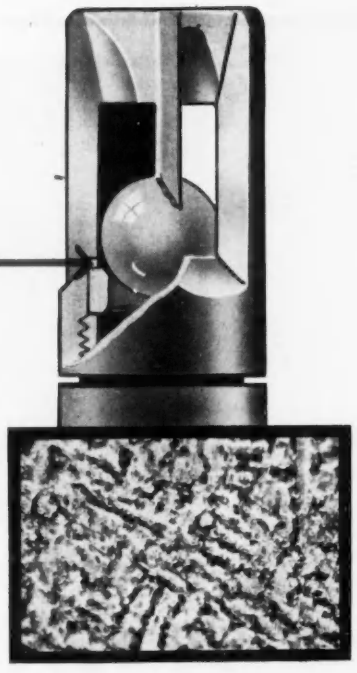
Template Serves Double Purpose

Working over marine wells can be easier if the crewmen have adequate footing around well head. In working from barges, deck level is usually too high above water, making it necessary to build some sort of catwalk around the christmas tree to support crewmen at convenient working height.

A circular template measuring about six feet in outside diameter, 18 inches in width and made of ⅜-inch galvanized steel plate not only provides a walkaround at convenient height, but serves as a brace to tie together the protecting pilings around the well. Experience has proven it is advisable to install some protection for the well head against collision from boats and barges. In this case, five treated pilings were driven in a six-foot circle around the well. Each pile was capped with this template that was held in place by angle braces bolted to the pile and welded to the underside of the template. By joining all piles together in this manner, additional strength resulted.

The template was placed about two feet above mean water level so that when crewmen were working on well head equipment they would be situated at a convenient working position. Four crewmen are shown breaking out a joint of casing. Galvanizing eliminates corrosion of the template, and its placement near the water level does not interfere with location of flow lines or christmas tree equipment.

Is this the seat of your pump trouble?



If you have a tough well that is down often due to valve failures, before you set a pump again ask your supply store for H-F Super Alloy Balls and Seats. The metallurgical properties of this Haynes Stellite® material are unexcelled in wear resistance qualities, the alloy is non-magnetic, unaffected by high temperatures, and guaranteed to be corrosion-proof to any known petroleum gas and/or fluid. The alloy (containing chromium, cobalt, and tungsten) is bonded into a very fine, dense grain structure *(see 200-x photomicrograph)* that makes the material extremely hard and efficient for abrasive fluids and hard pumping. Seats are individually mated to the balls, and each assembly is carefully inspected and tested before packaging in factory-sealed containers. Both the ball and the seat are of the same alloy, and sets are available in a full range of sizes in Regular and California types, with rib or flat seats (reversible). For your assurance of high quality, you can depend upon our more than 20 years' experience in manufacturing balls and seats for the petroleum industry. Next time specify Super Alloy...you'll settle on Super Alloy for all your wells.

Ask your supply store, or write us at Box 64 in Ft. Worth, for illustrated bulletins on this and other H-F pump products

H-F Super Alloy

Balls and Seats

Made with Haynes Stellite materials

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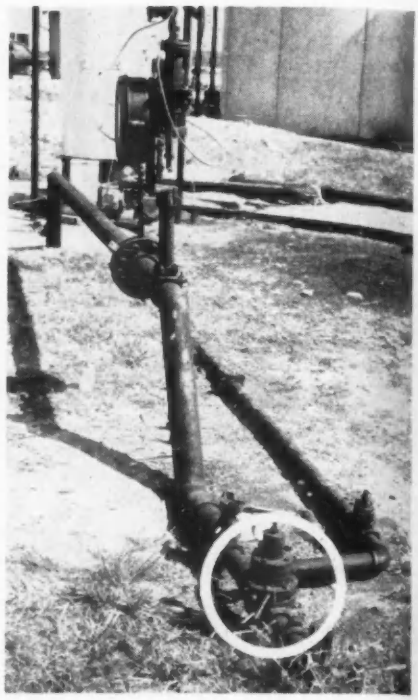
HARBISON-FISCHER MFG. CO. • FT. WORTH

"Best Pumps in the Oil Patch"

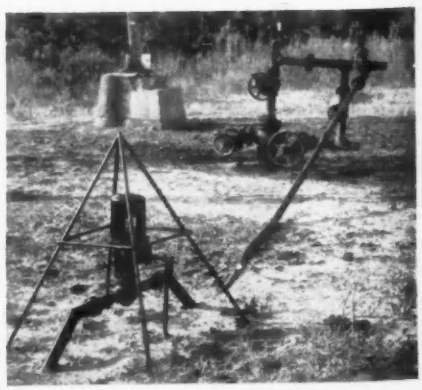
needed, it is the usual practice to take gas from the lease separators. In this case, the demand for gas was high, and the separator pressure dropped below that necessary to operate the dump valve. Result was that the separator filled up and oil overflowed into the gas discharge line.

To prevent a recurrence of this situation, a back-pressure valve was installed in the gas supply line downstream of the meter run as shown. This valve is opened so long as pressure in the line is above a predetermined value. However, when the gas demand exceeds the capacity of the separator and the pressure drops, then the valve will close at this predetermined pressure to maintain enough gas to operate dump valves. When the separator pressure builds up again, the back-pressure valve automatically opens to flow gas into the gas system.



Frame Protects Control Valves

Electrically-operated control valves on flow lines must be protected from livestock when these valves are exposed above the surface. A simple pyramid frame made from salvaged sucker rod serves the purpose adequately. Each of the four-foot legs were welded together at the peak and braced with four horizontal pieces as shown. This rod frame work was set in the ground over the exposed flow valve to prevent cattle from rubbing up against it and bending the protecting cover or break part of the unit. The valve controls the flow of fluids from the well in the background and it is essential that the valve function properly.



A JENSEN fact, in your favor . . .

In this limited space we'll not attempt to give you all the mechanical and engineering details of Jensen Units—just one important FACT! . . . the fact that any well is likely to be more profitable, more dependable and more satisfactory in every way when equipped with a JENSEN Pumping Unit.

We invite you to check on this statement. Ask people who own Jensen Units. Check our pages in the Composite Catalog. Better still . . . talk with your nearest Jensen man or write us at Coffeyville.

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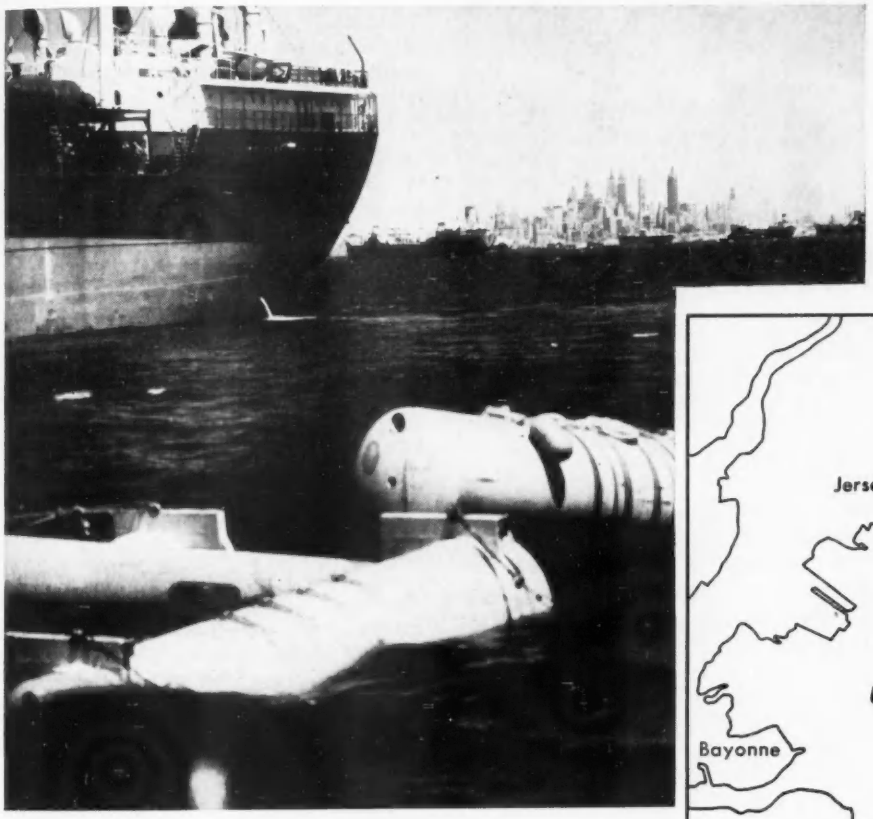
BROS. MFG. CO., INC., Coffeyville, Kansas

EXPORT OFFICE: 50 CHURCH ST., NEW YORK CITY

Transco Crosses the Narrows

Pipeliners Battle Changing Tides to Lay 24-Inch Line Across 6600-Foot Wide, 88-Foot Deep Entrance to New York Harbor



By DONALD M. TAYLOR
WORLD OIL Staff

ABOVE. With the Manhattan skyline towering in the background, Transcontinental Gas Pipe Line Company's 6600-foot underwater pipe line is launched from the shore of Staten Island.

RIGHT. Map shows where the pipe line crosses the Narrows, the world's busiest water highway.

THE roughest and the toughest." This is a pipeliner's description of the 24-inch underwater pipe line crossing which Transcontinental Gas Pipe Line Company was laying in late June across the Narrows, principal entrance to New York harbor.

Everything about this line across the world's busiest water highway calls for superlatives. It is the deepest, and one of the longest, of big-inch size. At the lowest point in the 6600-foot run from Staten Island to Brooklyn, the top of the pipe is 104 feet below the mean low water level of the swirling Narrows.

On a per-foot basis, the line is one of the costliest submarine pipe lines ever constructed. Before the first length of pipe could be pulled into the swift and treacherous currents of the Narrows, six months had been spent in dredging the 25-foot deep ditch for the line. To finish this phase of the job, a half-million cubic yards of clay, gravel,

sand and boulders had to be clamshelled from the bottom. This in itself was a painstaking job.

To make the job even tougher, the U. S. Army, which holds jurisdiction over harbor entrances, ruled that all spoil had to be dumped 50 miles from shore. The purpose of this ruling was to protect shipping in this vital area. To the pipeliners it meant that the entire half million cubic yards of spoil had to be loaded into barges and towed 50 miles into the Atlantic Ocean. Later, this ditch will be backfilled with 225,000 cubic yards of sand and gravel. This will bury the line under 15 feet of cover.

At one time during the crossing operation, the construction forces were threatened with defeat. The overall plan called for assembling the pipe in 800-foot lengths on the Staten Island shore. Then as the sections were pulled into the water they were welded together. To effect this plan three blocks of Clifton Avenue on Staten Island had been converted into a pipe launching ramp. Though narrow, the street served this purpose well. It slopes gradually to a dead end at the shore line. The pipe had been jointed into eight 800-foot sections (a job requiring six weeks) and rested on steel skids in the street spaced 20 feet apart. The entire length of the 24-inch seamless steel pipe had been covered with a 5/8-inch mastic coating to protect it from corrosion and with three inches of weighted concrete to bring the total weight to 563 pounds per lineal foot.

A gigantic, diesel-powered winch had been imbedded in the earth on the Brooklyn shore, 7000 feet away. From this winch, with a drawbar pull of 425,000 pounds, a 1¼-inch wire rope was spooled out across the Narrows to be attached to the bull-plugged end of the pipe line. Because of the great distance separating pipe and winch, this wire rope would lay on bottom of the ditch, even during the pulls. During the pulls the line was crossed by the S. S. Queen Elizabeth and the Battleship Missouri, not to mention the hundreds of smaller ships.

The countless hours of planning which started a year and a half ago and all of the manhours of work which started in September, had to be gambled on pulling the line across in a single piece. The Army ruled that shipping could not be interrupted. Thus on May 5, with throngs of Staten Islanders looking on, the pipe began its slow plunge into the water.

The eight sections were welded together as they were eased into the channel, one after another. As they were launched, they slowly rolled

Tod Pazdral, left, general superintendent of Samuel Gallucci and Sons Company, and Carl Whittaker, right, assistant construction superintendent for Transcontinental Gas Pipe Line Company, directed preparations for launching pipe across channel.

down a miniature railway, supported by converted mine carts every 40 feet. Cylindrical pontoons, 22 feet long and five feet in diameter, were attached to the pipe every 118 feet to lighten it in the water. They reduced the weight of the concrete-coated pipe from 563 pounds per foot to about 10 pounds. Each of the pontoons was pressured to 40 pounds per square inch to resist the crushing force of the deep water.

Things went well until May 7. Then trouble struck. Until then it seemed that this unprecedented and most difficult of crossings was to be effected with greater ease than a creek crossing. Six of the 800-foot sections had gone into the water, one every four hours. (This delay between pulls was necessary to make the weld and apply field moulds of mastic coating and concrete.) Just as the seventh section started into the water and as the Brooklyn goal was coming into sight, the pull line snapped. From this moment on, the five-knot tidal currents, the wind and waves took control of operations. By the time a second and heavier wire rope could be spooled out from shore and attached to the pipe line, sand and silt had the line in a vice-like grip.

Meanwhile, Transco officials suspected that the line had been damaged. They ordered the line tested. Results of air pressure tests indicated a break in the line. Then the line was parted and pulled back on shore in three sections. Crews began the task of retesting each section of line and preparing for another pull. The ditch had shoaled up from two to four feet and had to be redredged. Then the line was re-pulled.

Monument To Skill

Completion of the line will be a monument to the skill and ingenuity of Transcontinental engineers who designed it and directed the hazardous underwater pull. It is also a monument to the know-how and hard work of the crews of contractors, Samuel Gallucci and Sons Company and Collins Construction Company.

Actual construction work on the crossing started early last fall when the dredging got underway. Digging the ditch proved to be a tough job in more ways than one. The Narrows bottom was hard and contained too many boulders to allow the use of suction dredges. And U. S. Army Engineers ruled that only one dredge at a time could operate in the area because of the heavy water traffic. Added to these difficulties, was the problem of controlling the position of the dredge in the eddying currents caused by the meeting of ocean tides and the Hudson and East rivers.

In early October, a single 11-yard clamshell dredge started working 24 hours a day on the ditch. Early in February the ditch was complete. The huge trench was cut 25 feet below the bottom of the Narrows. The ditch itself was 20 feet wide at the bottom. This width provides room not only for Transcontinental's pipe line, but for two, 8-inch, welded, concrete-jacketed electrical conduits belonging to Consolidated Edison Company of New York. The width of the ditch at top varied from 40 to 300 feet.

While the work was going on, the area was sounded continuously to detect the shoals which were being built up on sides of the ditch. As they were discovered, they were removed.

The problem of maintaining position of the dredge in the swirling waters of the Narrows was a serious one. A slight shift of position in the water could bring a change in direction of the current and soon the dredge would be off line.

This problem was solved by an elaborate system of line and fan markers. Range lights were set up on opposite shores in such a way that pairs of them lined up on the center line and on 50-foot offset lines marking the ditch. By shifting the dredge to where certain two of the lights lined up, dredgemen could fix position with respect to ditch line.

The currents had yet another effect

on the dredging operation. All of the ditch had to be dredged twice. Once the bottom was reached, the ditch was allowed to stand for a month. During this interval, it shoaled up for about three feet. Then the dredge retraced its path, and once again clamshelled the ditch to proper depth. This stabilized the bottom. Once stabilized, the scouring waters of the Narrows prevented any additional buildup on bottom.

When work on the ditch neared completion, the Howland Hook pipe yard on Staten Island boomed into action. H. C. Price Company applied the mastic coating and the three-inch weight coat to the single joints of pipe. Sufficient barytes were added to the weight coat to make the pipe scale 563 pounds per lineal foot in air or about 210 pounds per foot in water. This means that the pipe weight was designed to scale 67 pounds per running foot in mud weighing 90 pounds per cubic foot. This weight was designed to insure that the line would never float, even in the heavy muds sometimes encountered on bottom of the Hudson River. At the same time the pipe was light enough to minimize undue stresses caused by its own weight.

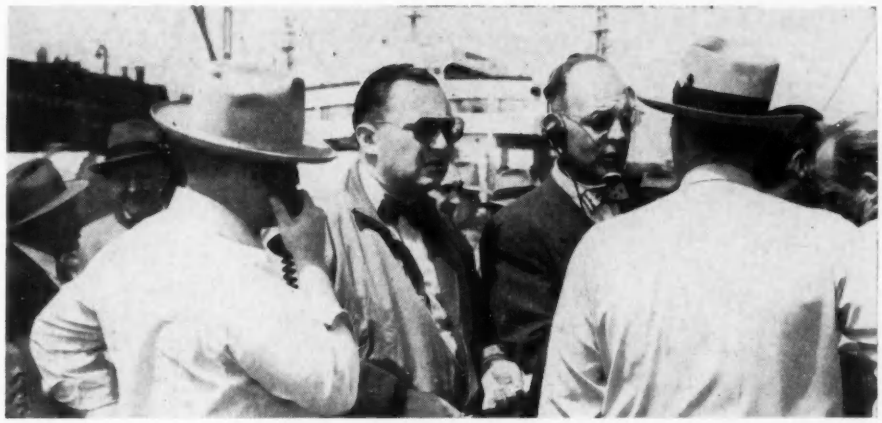
The pipe weight in air can be broken down as follows:

24-in. .500 wall pipe . . . . . 125.5 lbs. per ft.
⅝-in. mastic coating . . . . . 45.7 lbs. per ft.
3-in. concrete wt. coat . . . 391.8 lbs. per ft.

After the individual joints had been coated in the pipe yard, they were hauled to the Clifton Avenue launching ramp. Here the joints were welded into 800-foot sections. Each weld was carefully inspected and X-rayed. Then it was covered with mastic field mound and concrete joint mould.

While this was going on, other preparations for launching were being made. Over on the Brooklyn side, crews were pounding a 20-foot-diameter hole in the granite seawall at the foot of 92nd Street and Shore Parkway. Underground excavations were made for the two winches to be used in pulling the pipe. The huge Collins Construction Company winch which was hauled from Victoria, Texas, for this job, was set on a reinforced concrete foundation deep in the earth 170 feet back from the seawall. A dynamometer which was used to indicate force of the pull was set up near the breached seawall. Connecting the two underground cells was a road casing through which the pipe line will run.

On the Staten Island shore a newly invented pipe launcher was set up near the edge of the water. This device cradles the pipe between pneumatic truck tires as it projects the pipe into the water from the sloping "pipe ramp." One of the devices is mounted on pontoons a short distance out in the water to allow for the rise and fall of the tides.



The expressions on the faces of these men indicate the tension that existed during the task of laying the pipe across Narrows. Raymond Crowe, with telephone headset at right, is the Transcontinental chief engineer. During pull he gave orders via telephone to winch operator pulling pipe from Brooklyn side. Transco's assistant chief engineer, Bob Topper, center, and Jim Crawford, left, stand by to assist during operations.

When preparations were complete, the Gallucci Company crews were turned over to Transcontinental engineers who directed the pull across the mile-and-a-quarter-wide channel. The first 800-foot section of the line was flopped over onto the railway trucks which were lashed together 40 feet apart. After the pipe had been chocked, the pontoons were placed on saddles on top of the pipe and strapped to the pipe by four double wraps of two-inch-wide steel banding. The outer bands of all four wraps sat inside the jaws of cutters. These four cutters were designed to operate by pulling on a single manila line which was attached to a floating buoy. Thus, once the pipe was in place, the manila line attached to the buoy could be pulled, causing the cutters to break the steel bands, releasing the pontoon from the pipe.

Trouble arose when wire rope pulling pipe line snapped. Here crews with diver work to attach new wire rope to end of pipe line. Accident happened when end of line was only 1600 feet from Brooklyn shore.

Yet, because of the heavy water traffic, the buoys could not be allowed to float on the surface during the launching operations. Thus arose one of the most difficult problems of the job—how to release the buoys from the pontoons from the top of the water at will. The answer proved to be simple. The Gallucci forces ran a ½-inch wire rope down the length of the pipe as it was launched into the water. It passed on top of the pipe and on top of the pontoons, lashed in place by ordinary binder twine. The buoys in turn were lashed to the pontoons with binder twine passing over the wire rope. Once the pipe was in place the small diameter wire rope could be spooled in from a small barge acting as a zipper, cutting loose the lashing of the buoys one at a time.

Unfortunately, Clifton Avenue did not run directly down the direction of the ditch line; it made a 13½ degree angle to the right. For this reason the pipe had to be launched out of the ditch and it remained out of the ditch for about the first 800 feet.

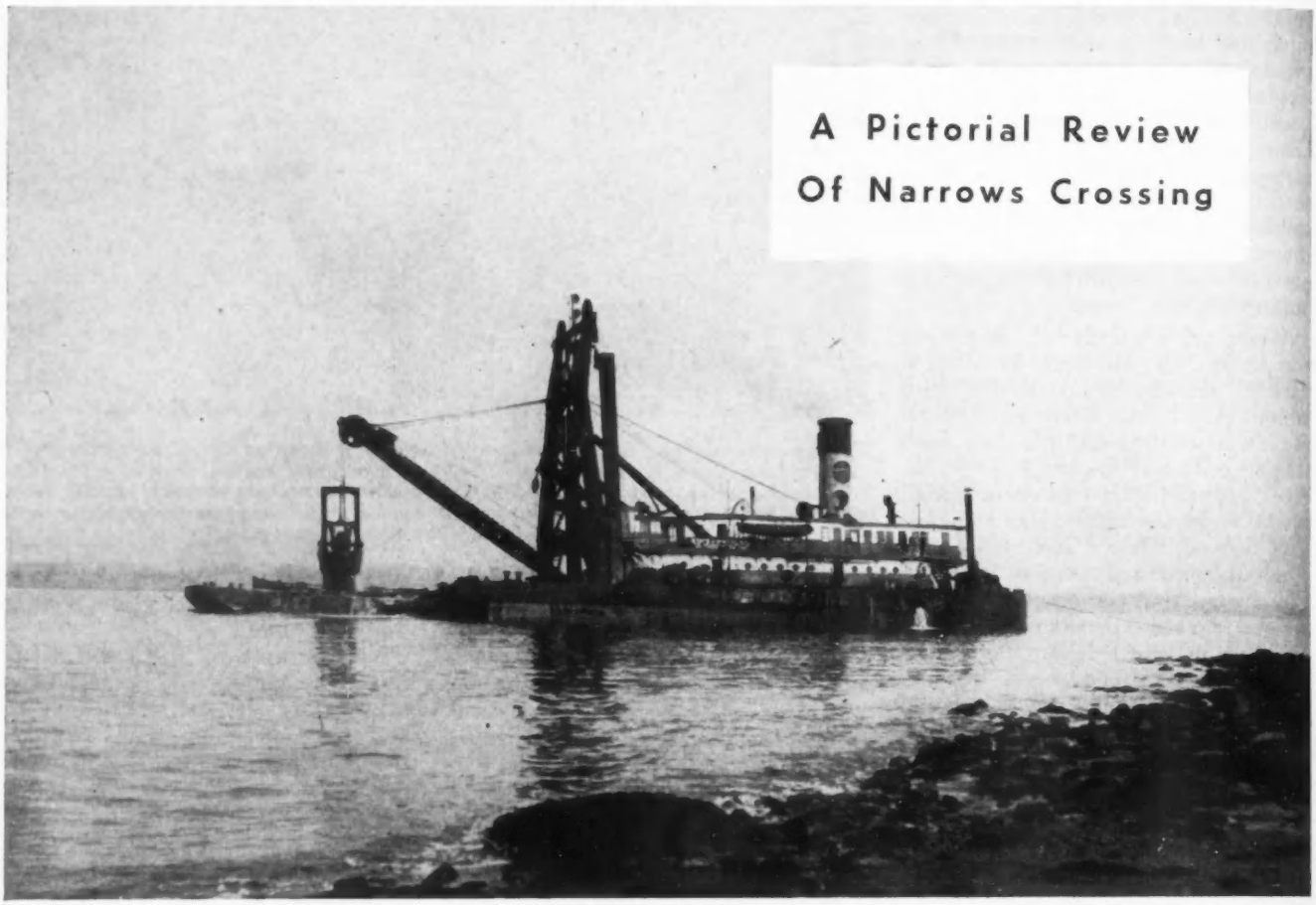
Once the pipe had been pulled across the water, a fathometer check was run on the ditch. Then a diver descended every 100 feet to check the location of the pipe in the ditch and to aid in plumbing its depth. In so far as possible, the pipe was worked upstream to leave room for the two eight-inch lines which would share the ditch. Once the location was satisfactory the pontoons were released one at a time.

They popped to the surface and up into the air, driven by a buoyant force of about 23,000 pounds.

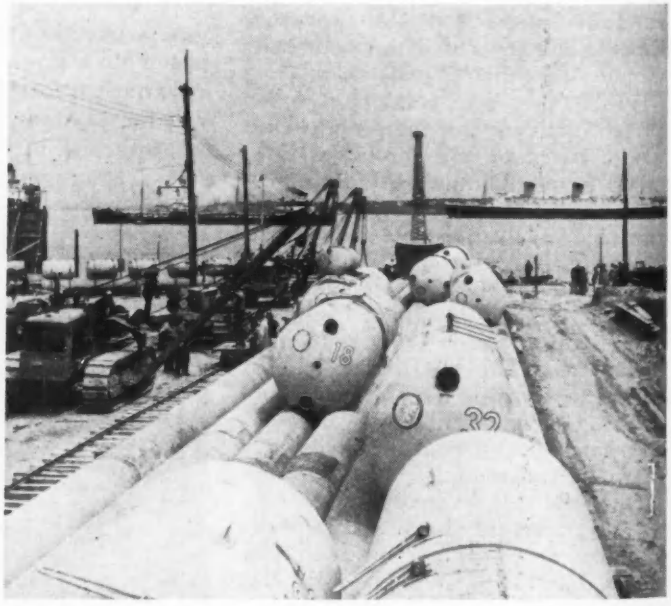
Then work began on pulling the twin eight-inch conduit lines across. The backfilling operation followed.

(See pictorial review on following pages.)

A Pictorial Review Of Narrows Crossing



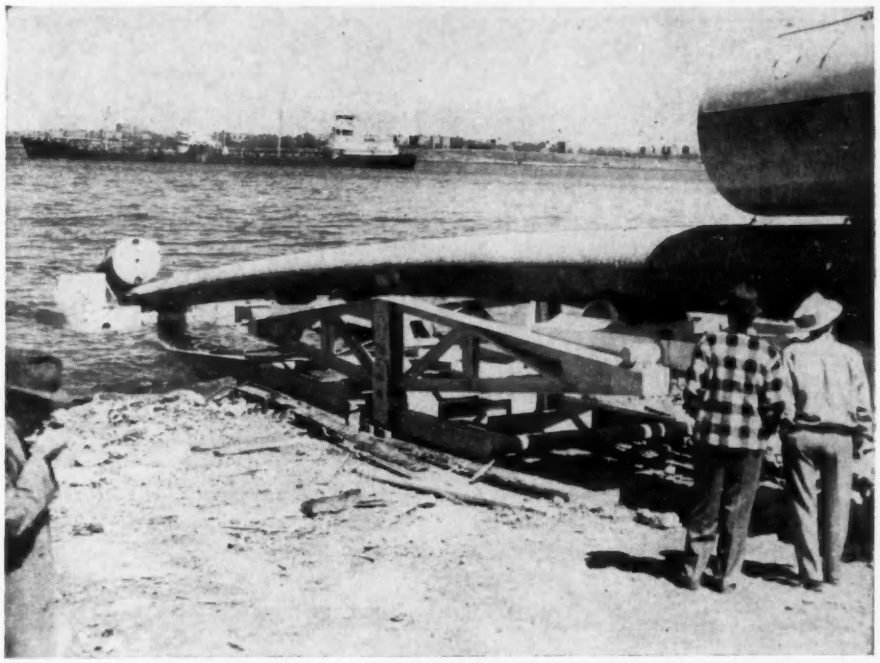
DIGGING THE DITCH. A ditch 25 feet deep and 6600 feet long was dug with clamshell and bucket. Working 24 hours a day, one dredge completed the operation in six months. The job began last October. Some 425,000 cubic yards of sand, gravel, boulders and clay was dug from the bottom of the Narrows. It was taken 5Q miles out into the Atlantic and dumped. Once dug, the ditch was kept clean by the eddying waters of Narrows.



STREET CONVERTED TO PIPE RAMP. Three blocks of Clifton Avenue on Staten Island was converted into pipe-launching ramp with miniature railway (left). During pulling operations, the pipe rode on converted mine trucks spaced 40 feet apart. The rails were 30 inches apart and directly over Transcontinental's 26-inch Staten Island pipe line, which will tie into the 24-inch crossing. In photo at right, the Queen Elizabeth sails past foot of Clinton Avenue launching ramp. And beyond the ship, 6600 feet from Staten Island shore, is Brooklyn, the goal of the crossing.

"The Thing"

The official title of the device at right is "Hydro Pneumatic multi-differential self-stabilizing pipe launcher." Pipe line crews called it a "Monkey Motion" or "The Thing." Here it gently projects the 24-inch concrete-coated pipe line into waters of the Narrows. The device pivots at center like see-saw. Bearings at each end permit further adjustment. Pipe rolls on 18, 10:00 x 15, 14-ply tires. Six are on section of launcher supported in edge of water by pontoons. This takes care of tides. Launcher was invented by Samuel V. Collins, president of Collins Construction Company.



WELDING OPERATION. After the individual joints had been coated in pipe yard, they were welded into 800-foot sections at the launching ramp. As each weld was completed it was X-rayed. Here a technician is locating radioactive cobalt inside pipe with Geiger counter.

Boyd T. Collier, Transcontinental engineer, examines X-rays of welds made on 24-inch seamless steel pipe.

CONTROLLED FLOTATION. In air the pipe weighed 563 pounds per running foot. Pontoons plus natural buoyancy of sealed pipe cut weight to about ten pounds per foot when it entered water. Four sets of steel bands which strapped pontoon to pipe were cut from surface of water by pipe cutters attached to manila line tied to small buoy. Buoy was lashed with soft line to pontoon. When pipe was in place the buoy could be cut loose by pulling on ½-inch wire rope running down pipe over pontoons. Pontoons were pressured to 40 psi. (The small buoy can be seen at far end of pontoon.)

The Pull

Looking from Brooklyn toward Staten Island. The seawall had been breached and road bored. Powerful winch which pulled pipe line into water by 7000-foot-long, 1¼-inch wire rope is in excavation in foreground. For last 2000 feet, 2⅛-inch, 6 x 49 wire rope was used.

HEAVE-HO. As pull develops, technician takes readings on dynamometer. He relayed wire rope stress to winch operator by telephone. This photo was taken in excavation near seawall breach. Wire rope runs behind operator to excavation across street.

RIGHT. Giant winch pulls on pipe. Operator in foreground receives dynamometer readings from operator in photo above. Behind expanded metal, a technician kept in constant touch with chief Transco engineer and directed winch operator. Winch has 632-to-1 gear ratio, could pull 425,000 pounds if necessary. Winch was mounted about 15 feet underground.

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Ask the man who operates a "cat" on a pipeline project and he'll tell you how Pitt Chem Enamels save you time and money. He knows that a spread can cover more pipe per day with Pitt Chem Enamels because they heat up faster, flow better from kettle to pipe, and coat more pipe per ton of enamel.

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Location of Pipe Line Is Checked in Narrows

ABOVE. After each pull, engineers ran fathometer survey to determine location of pipe. Here on board the boat, "Why Worry?", James P. Crawford, assistant chief engineer, checks position of boat by range lights on shore. Fan marker lights on fort at extreme left read distances from shore when boat is on ditch line.

ABOVE. Sal Bellassai, Transcontinental field engineer, marks position of boat on fathometer chart. A dip in curves indicated the ditch. Small pips indicated position of pipe.

Rigging oscillator on fathometer aboard the "Why Worry?".

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EDGAR TOBIN AERIAL SURVEYS

502 West Mistletoe — San Antonio, Texas

Sandblasting and cleaning bottom of tank.

Glass mat is placed over the primer coat.

Final coat of plastic has been poured over mat.

Glass Fiber Protects Tank Bottoms

Coal Tar and Plastic Also Used In Mat to Reduce Corrosion, Avoid Replacement and Save Steel

By CARL G. DANIELSON

Midwestern Engine & Equipment Company, Tulsa

TO AVOID replacement expense and to conserve steel, a method of coating the inside of tank bottoms using glass fiber mat and various types of coal tar and plastics has been developed. It is being used extensively by some of the major oil companies and has been found economical and satisfactory.

This coal tar and plastic coating reinforced with glass fiber mat protects the inside of crude oil storage tanks against internal corrosion caused by action of basic sediment and water and the electrolytic action of scale and steel.

Maintenance of crude oil storage tanks has for a long time been a problem because of the impurities present in the unrefined oil and also because of the scale which forms on the inside of the tank and eventually falls to the bottom. This scale forms, as a rule, on the inside of the tank top and also on the side walls that come in contact with the atmosphere above the liquid level.

In time, this scale drops and, in coming in contact with the tank bottom, sets up an electrolytic action. This electrolytic action is corrosive and in time the tank bottom is rendered useless because of leakage and loss of crude. Such storage tanks commonly affected are of 55,000-barrel capacity and larger. The cost to replace such tank bottoms varies but the average will be in the neighborhood of $5000 for labor and a considerable quantity of steel plate.

Common procedure in the method devised to protect the tanks is as follows:

1. The tank bottom and sides 36 inches up from the bottom are scraped and steel brushed to remove all scale and rust. Thirty-six inches represents the average depth of the bottom settlings and water that cause corrosion.
2. The tank bottom and sides to the basic sediment line are sand blasted.
3. The tank is cleaned of sand and inspected for holes.
4. All holes found are patched by welding a plate over them.
5. The first coat of enamel blend or primer is poured, using roofers' pouring buckets and spread with 36-inch-wide push broom. The entire surface of the bottom of the tank is covered and allowed to set up.
6. Starting opposite the entrance,

■ CONTINUED ON PAGE 230

LEFT. Drawings start and end in drafting room. Here a draftsman corrects bill of material which appears on each drawing to conform to material installed.

BELOW. As work progresses, construction photos are posted for each project. Photos supplement drawings and form permanent record for operating company.

New System Saves Time and Money on Completion Reports

Simple Plan Makes Complicated Job Easier By Planning Inventory as Stations Designed

By M. T. DUDDLESTON
Chief Engineer
Fish Pipe Line Construction Corporation

SAVE money by planning for completion reports at the time stations are designed. This scheme was used to good advantage by Texas Illinois Natural Gas Pipe Line Company and Fish Pipe Line Construction Corporation. They finished most of the completion reports on five compressor stations and five meter stations shortly after construction ended. This saved money and countless man-hours in accounting for materials and labor used.

The completion report is a physical check or inventory which shows disposal of materials used on an interstate gas company job. It is used to group material items according to retirement units set up by the Federal Power Commission and to show the items lost or expended in construction. Although FPC does not specify the exact accounting code numbers and accounting procedures, it does require that materials charged to a job be entered on the books according to basic retirement units.

Sometimes the cost of preparing this report is a major factor. For example, it took over two years for one company to finish completion reports on a number of compressor stations. Yet actual construction had lasted less than one year.

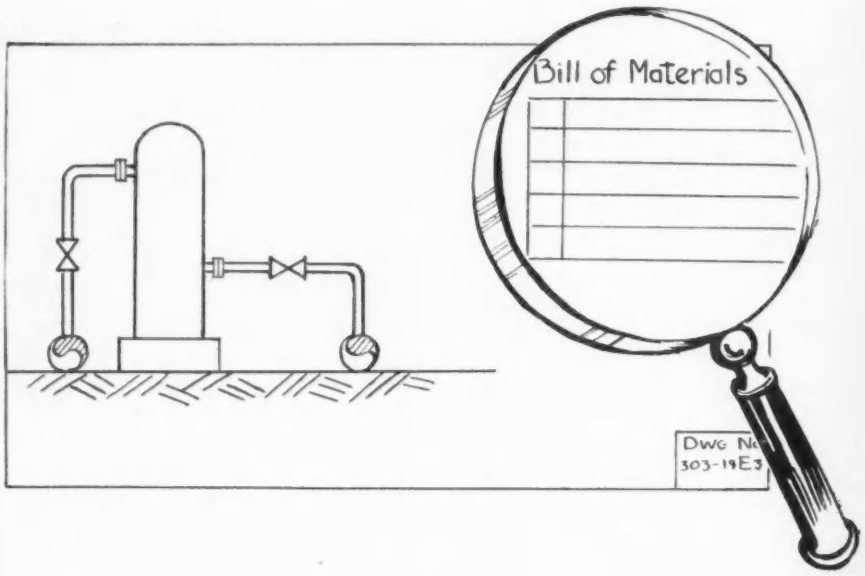
The overall plan devised by Fish Corporation and Texas Illinois Natural Gas to speed completion reports was simple. The first step was to incorporate a bill of material on each drawing. This was a list of various items to be used in construction of installations shown on each drawing. It served as a basis for purchase orders and receiving reports. Insofar as possible only one retirement unit or specific accounting code was listed on each drawing.

The second step was to assign an engineer to each job to supervise the reports. He corrected drawings to conform to installations as they were constructed. He accounted for each item used in construction. He noted, on the bill of material the material items which were sold, scrapped or used.

This was the beginning of a program which ended in providing completion reports and corrected drawings soon after construction ended in the field.

One of the keys to the system was

Material items are posted on material control cards. Each card lists one item of material.



Bill of material was incorporated on every drawing. Scope of drawing and bill of material itself were limited to one accounting code number. After approval, drawing went to specifications section, material control section and purchasing department.

ITEM 3" TEE, Weld, Std. Wt., Gr. B, Smls — Station 205

B/M			B/M			PURCHASE ORDER											
No	Amt	Cum	No	Amt	Cum	No	Amt	Cum	Prom	Rec	Used	Dwg No	On Hand	Used	Dwg No	On Hand
115	3	3	909	1	30	A9909	9	9	Stock	9	2	303-19-E31	57			
116	2	5	211	6	36	A1297	4	13	"	4	2	303-19 E29	55			
209a	1	6	566	2	38	A1135	1	14	1-15	1	10	303-				
230	1	8														
308	1	9														
527	1	10														
567	2	12														
577	1	13														
40	7	20														

Material Control Card. Note that a running tally shows number of ells on hand, number used and where used. This is basis for completion report.

the organization of the engineering department in the Houston office of the Fish Corporation. The mechanical division of the engineering department was divided into design, specifications, material control and drafting sections.

The design and drafting sections began the drawings and made the original bill of material. After approval the drawings went to the specifications section where specifications were written for instruments, valves etc. The drawings were then sent to the material control section where requisitions were prepared and material items entered into permanent record books. Next the drawings and requisitions went to the purchasing department.

There the materials were listed on the drawings. The purchase order conformed to the specifications shown on the material requisition. The number of the purchase order was posted on the bill of material at the time it was issued.

The materials control section was a liaison group with many duties. One duty was to avoid duplication in material orders. This problem arose when many hard-to-get items such as large valves and fittings, scrubbers and engines were ordered at the beginning of the job. The materials control section kept a card index of all material ordered against a certain job. And it was a simple matter to prevent duplication.

The material control card system kept by this section listed each class of material items separately. For example, all of three-inch, forged steel 90-degree weld ells ordered for any one station were shown on one card. A tally was kept as the drawings—each with the bill of materials were processed by this section. When purchase orders were issued for these ells this section noted the number and posted cumulative totals. Also noted were the delivery promises and number received on the job.

Later when corrected drawings were received from the field, a running tally of three-inch ells was posted, listing drawing number to show disposal.

The listing of material on each drawing was a departure from usual practice. But an even sharper departure was the limiting of the material and installations shown on each drawing to one accounting code. In other words the bill of material and the drawing itself were marked with a single code account number furnished by Texas Illinois Natural Gas Pipe Line Company. This code complies with, and in some cases exceeds

7½ TON FORGINGS

NICKEL ALLOYED STEEL FORGINGS for the new $55,000,000 Mid-Valley pipe line ... a joint undertaking of Sun Oil Company and Standard Oil of Ohio . . . built to carry 150,000 gallons of oil daily through pipe of 20" and 22" diameter. These rings are 83" OD x 76" ID, with a face width of 21".

How Nickel Alloyed Steel Strengthens Gears that Power a Pipe Line

These giant ring gear blanks weigh 7½ tons each...

This pair is from a batch being forged, heat-treated and rough-machined at The National Supply Company's plant in Torrance, California.

After teeth are cut and finished, all will serve in pumping stations along the new 100-mile Mid-Valley pipe line.

These nickel alloyed steel forgings will form the outer rims of bull gears in eight 1700-horsepower speed-increaser units... the largest ever built for pipe lines in this country.

National Supply engineers specify Type 4340 nickel-chromium-molybdenum steel for these ring gears, to assure ample strength, toughness and wear resistance. Excellent depth hardening properties make Type 4340 particularly desirable for heavy duty forgings. Moreover, outstanding fatigue strength characterizes this nickel alloyed steel.

At the present time, most of the nickel produced is being diverted to defense. Through application to the appropriate authorities, nickel is obtainable for the production of engineering nickel steels for many end uses in defense and defense supporting industries.

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accounting requirements set up by the FPC.

Engineers assigned to each field station were called "inventory engineers" for want of a better name.

These engineers were under the direction of the engineering department and received two copies of each construction drawing issued. As the construction developed, these men followed each phase step by step: checking the dimensions, elevations, alignment and material. Any changes or discrepancies were recorded on the drawings. A material inventory form was filled out listing all materials used giving the account number, purchase order number, drawing item number and complete description of material.

This form in triplicate, with the marked "as built" print, was forwarded to the Houston office where one copy of the material inventory was handed to the material control unit. When posted on the card file the cycle was complete. A true record of all material had been recorded.

The second copy was forwarded to the accounting department where the material was priced making it possible to arrive at an accurate "as built" material cost.

The "as built" drawing was sent to the drafting room where all changes were recorded on the tracings. In the final analysis, the Texas Illinois Natural Gas Pipeline Company will have a complete file of "as built" tracings as well as a correct listing of the material actually used in the construction program. Similar methods were employed by the accounting department for labor equipment rental and other units of the project.

New System in Action

The advantages of this system can best be shown by tracing one material item from design to completion posting. Take, for example, a two-inch, forged steel, 90-degree weld ell used in scrubber oil piping.

Design and Drafting Section. The design section roughs out the scrubber oil piping showing two-inch lines. The draftsman draws all of the scrubber oil piping which includes, for example three two-inch ells. Upon completion of the drawing he makes a material takeoff and lists in the bill of material the three, forged steel, two-inch 90-degree weld ells. The drawing is checked for accuracy and approved by the chief engineer.

Specification Section. The drawing goes to this section for a check and the wall thickness, grade of steel, etc., of the ells are checked against specifications prepared by Texas Illinois Gas. The material requisition is then prepared.

About the Author

M. T. DUDDLESTON, chief engineer, Fish Pipe Line Construction Corporation, is a native of Illinois. After attending Washington University, he began his career in the gas and oil industry with Ford, Bacon and Davis in 1926 as field engineer. He went with Natural Gas Pipe Line Company of America in 1930 as resident engineer on compressor station construction and later became pipe line superintendent. In 1934 he joined Williams Brothers Corporation, advancing to general superintendent. After serving as an officer in the U. S. Navy from 1942 to 1946 he became general superintendent with Williams Brothers Overseas Corporation in Venezuela and the Middle East. He joined the Fish organization in June, 1950.

Material Control Section. The bill of material on the drawing and the material requisition is checked. The two-inch ells are then posted on a material card which lists *only forged steel, two-inch,* 90 *degree weld ells.* These three are posted under bill of material number.

Purchasing Department. Purchase order is prepared from the bill of material on the drawing. A copy of the order which shows the three two-inch ells goes to the material control section and to the construction job in the field. The number is noted on the card system in the material control section.

Inventory Engineer. When the two-inch ells are installed on scrubber oil lines, this engineer makes notes on the field drawing. When the installation is complete, he sends a corrected drawing to the engineering department.

Material Control Section. The drawing number and the number of two-inch ells are posted on the material control card, showing final disposal of the ells.

Drafting Section. The tracing is corrected to conform to the actual installation and the bill of material is corrected as shown by the inventory engineer.

Coating Tank Bottoms

▪ CONTINUED FROM PAGE 226

glass mat is placed on the surface of the first coat and lapped two inches until approximately a six-foot width is obtained.

7. The second coat is applied over the glass mat 3/16-inch thick. This coat is poured in the same manner as the first coat and the heat of the second coat is great enough to soften the under coat so that the two coats blend into one solid mass rather than forming two laminations. Thus the glass becomes an integral part of the coating, adding greatly to its flexibility and mechanical strength.
8. This operation is continued until the entire bottom surface is covered.

The glass performs the following functions: It adds considerable mechanical strength to the coating and thus, any corrosion from the ground contact side of the tank bottom would have to be quite extensive before the weight of the oil on the inside of the tank would break through the glass impregnated coating.

It adds to the flexibility of the coating and allows the coating to come and go with the tank bottom without cracking the plastic or coal tar coating. This flexibility is important because the tank bottom changes position as the liquid level changes and also varying temperatures of the outside atmosphere will cause expansion and contraction.

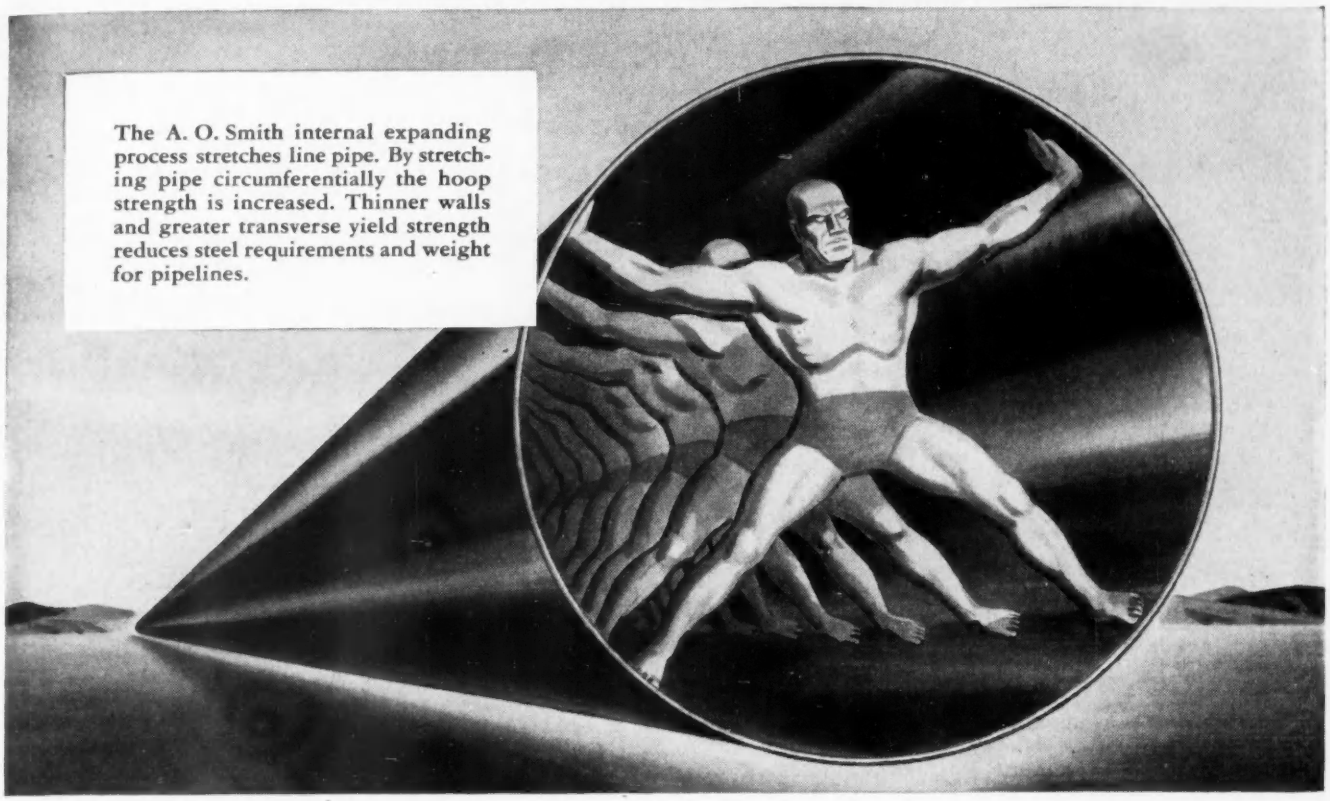
It maintains the dielectric strength of the protective treatment just the same as underground pipeline wrapping applications.

It reduces cold flow when used with low melting point enamels or plastics.

It does not absorb moisture or wick moisture to the tank bottom as it is inert and will not rot.

The main purpose of using glass mat is to reinforce the coating so that the coating will not rupture or crack, thus allowing corrosion and electrolysis to disintegrate the steel tank bottom. It has always been difficult to prevent scale from forming on the upper portions of the inside of steel crude oil storage tanks, but the damaging effects of electrolysis that occur when the scale touches the tank bottom will cause leaks and loss of crude.

FIRST names in pipelines depend on the FIRST* name in line pipe


The A. O. Smith internal expanding process stretches line pipe. By stretching pipe circumferentially the hoop strength is increased. Thinner walls and greater transverse yield strength reduces steel requirements and weight for pipelines.

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This stretches the pipe, increasing the circumferential yield strength as much as 30%. Lighter wall pipe can be used for the same operating conditions. Material savings in steel, freight, and field welding costs are obtained.

In these days of restrictions on the use of critical materials, of which steel is basic, the A. O. Smith internal expanding process, which assures uniformity of SMITHway Line Pipe, reduces the tonnage of steel required for any given pipe line.

Through its application of new and sound engineering design and developments in the manufacture of large diameter pipe, A. O. Smith is recognized as the leader in this field.

* FIRSTS by A. O. Smith • Welded line pipe • Internal expanded pipe • Light wall large diameter pipe • World's largest producer of large diameter welded steel pipe.

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Weather Conditions Overcome To Give North Dakota an Outlet for Its Oil

Workmen thaw ground for excavation in North Dakota. When ditching for pipe line, they spread lignite coal, old rubber tires, anything that will burn on right-of-way; let it smoulder about 48 hours, then run ripper and ditcher through coals.

First Williston Basin Pipe Line Completed

By CARL I. HUSS

Editor, The Connecting Rod

Service Pipe Line Company, Tulsa

IN 1864 General Alfred Sully, leading his troops through the treacherous gullies and tumbled buttes of the Dakota badlands, described the country in five words:

"Hell with the fires out!"

That chorus of "amens" you hear today, 88 years later, comes from a certain group of pipeliners and construction workers. They agree with the general. They've been in North Dakota. They're the men who last winter laid Service Pipe Line Company's gathering system in the vicinity of Tioga in Williams County, North Dakota.

Service Pipe Line Company pushed the project through to completion under almost intolerable weather conditions. The project was finished in late December and North Dakota's producers had transportation service by pipe line from their wells to the refineries.

North Dakota's first crude oil pipe line measures a little over 14 miles and has a capacity of about 18,000-barrels a day. Buried 30 inches in the earth, about 12 miles of the line is six-inch pipe. This runs south of Tioga for about 10 miles with two miles extending to the north of town. It is not coated. Two miles of four-inch laterals connect four wells, including the discovery well, the Amerada-Iverson 1.

Original plans called for the lines to have gravity flow, but this didn't work out. Two small field units provide power for moving the oil to the tanks and loading rack.

The system transports oil from the wells to a 12-car loading rack on a specially built 1200-foot spur of the Great Northern Railroad at Tioga.

Map of North Dakota's first crude oil pipe line.

BELOW. Closeup of electrically-driven rotary pump and risers for unloading tank trucks. This unit is used to unload trucks hauling oil from new wells not yet connected to Service Pipe Line Company's gathering system. Note new fences in background. They prevent snow from drifting across tracks of Great Northern Railroad.

ABOVE. Sam Morrison, left, connection foreman from Wyoming, and Jack Keyes, area engineer, working at Dilland station. The 30-horsepower unit was installed to pump oil from lease tanks to tanks at loading rack site in Tioga.

Two 5000-barrel tanks receive the oil there.

Three Service Pipe Line engineers visited Tioga in late October. They were the advance party. The weather was mild then. They made a thorough reconnaissance of the area and decided where the lines should be laid. A. H. Newberg, chief engineer, Tulsa, and R. R. Strand, Wyoming division manager, thereafter would make only periodic visits to the project. But the third man, Jack Keyes, Wyoming area engineer, would see the project through.

Before it was completed Keyes would see sub-zero temperatures, and blizzards. And he would see workers forced to quit work because of frozen faces and limbs.

Keyes and his helper drove into Tioga about the third week of November last year to survey the right-of-way. By then contracts had been awarded for the lines, an office building at Tioga and two 5000-barrel steel tanks nearby.

Keyes' survey went along smoothly, but before he was done he and his helper were using steel frost pins before sinking their wooden stakes in the ground. It was a rough job for the ditchers. One ditcher arrived from a Wyoming job November 26, and started work the next morning.

How it got along is revealed in the first daily progress report: "Construction company completed 1546 feet of ditch November 27. Due to a large amount of rock and about three feet of frost, it was necessary to use a ripper, mounted on a tractor, ahead of the ditching machine."

The ditching operator had only to talk to any farmer in the vicinity to know there would be rocks, plenty of them. Deposited by glaciers thousands of years ago, the rocks range in size from a man's fist to three or four feet in diameter.

For years North Dakota farmers have been whipping the rock problem with "rock pickers." These ingenious machines have steel fingers 10 inches long that sink into the ground. Farmers pull the rock pickers through their fields and they rake the rocks out of the ground and convey them to a box on the rear of the machine.

They have to repeat the operation each year, because the severe frost heaves rocks from the subsoil nearer the surface.

The terrain around Tioga is ideal for pipe lines in that it is gently rolling with no extreme ups and downs. The relief varies not over 150 to 200 feet. The land averages about 1900 feet above sea level. About 50 percent of the land is pasture, the other 50 percent is cultivated. Principal crop is spring wheat.

The second day the ditcher made 2900 feet of ditch; the third day, 3100 feet. Grading for the tanks was underway and going smoothly. Excavation for the loading rack piers was 90 percent complete, according to the December 2 progress report. But another paragraph in the same report indicated things were getting rougher: "There has been about 36 inches of frost in the ground, which caused the contractor to use air tools in making this excavation."

The fires General Sully spoke of went out December 7. High winds and snow and six-degree weather shut down all operations for the day. This was only a preview of things to come.

December 14, 15, 16 alone were enough to earn the name "Operation

Connection foreman Sam Morrison from Service's Wyoming division digs out Dilland station, North Dakota's first crude pipe line station. Snow isn't excessive in North Dakota, but winds pile drifts over units. Morrison remained on the job from early December to March as company inspector.

Service Pipe Line Company personnel make electrical installations on 12-car loading rack. Fred Meats, right, telephone and telegraph supervisor for Service's Wyoming division, had to lay off work a few days with frostbitten feet. Temperature dropped as low as 37 degrees below zero.

Chilblains" for the project. A temperature of 19 degrees below zero with 15-mile-per-hour wind was reported for December 15; and 22 degrees below zero was reported for December 16. All work froze to a halt.

It was so cold that the air turned blue—a phenomenon that happens in North Dakota when ice crystals literally form in the atmosphere. On the coldest day the temperature plummeted to 37 degrees below zero.

"There were times when we spent most of the day getting the equipment to run," Keyes said. "Seemed like about the time we got it started, it was time to shut down for the day. Some days we never got it started. Those were the days it was so cold it was a full-time job keeping warm."

Workers kept moving. Standing still for more than a few minutes meant frostbitten feet.

Keyes explains how they made ditch after the ground froze completely. "We spread lignite coal, old rubber tires and anything else that would burn along the right-of-way and set fire to it. We covered it with straw and let it smoulder 24 to 48 hours. Then we ran the ripper through the hot coals and the ditcher came along right behind the ripper.

On December 20 they were able to make only 500 feet of ditch.

"That's when we decided to shut her down," E. A. Slade, maintenance superintendent for Service Pipe Line, said. "We laid the remainder of the pipe—two miles of six-inch and a half mile of four-inch—on top of the ground."

Service came back in the spring when the ground thawed and dried out, and ditched the lines laid on the surface.

Slade praises the landowners for their understanding and cooperation. "They were glad to see us come and gave us all the assistance they could. We didn't clean up the right-of-way properly last winter. We couldn't. The landowners understood the lines were put in under difficult conditions. They didn't complain. We got right in there as soon as we were able this spring and cleaned up the right-of-way."

Tips on Weather

Speaking of weather conditions, Slade passes along the following information for the guidance of other pipe line crews: "The ground is pretty well open until the last of November when winter really sets in. Frost goes deep into the ground in a hurry about then. The spring thaw usually starts around the first of April. Then the ground gets soggy and equipment will sink until it hits the frozen subsoil. The ground is well on the way to drying out the first week of May and all frost is out of the ground by June. Actually the snowfall isn't excessive, but the high winds make it drift badly."

At the site of the loading rack, construction workers were battling the weather just as hard as the ditchers were. Before concrete pours they warmed the aggregate by spreading it over sections of culvert and building fires inside. Of course they heated the water to be mixed with the cement. All their mixers had burners installed on the drums.

They constructed a two-by-four framework over the building site, draped a tarpaulin over it, then installed oil burners inside. When the interior was warmed sufficiently, they poured their concrete foundations. They kept the oil burners going until the foundations set. They erected the sides of the building and put on the roof before pouring the concrete floors.

Christmas Day was fairly decent—only six below, but clear—so work went on.

The project was supposed to have been done in twenty days, but bad weather changed that schedule. No time to be taking holidays now. The men promised themselves a big celebration when the job was done.

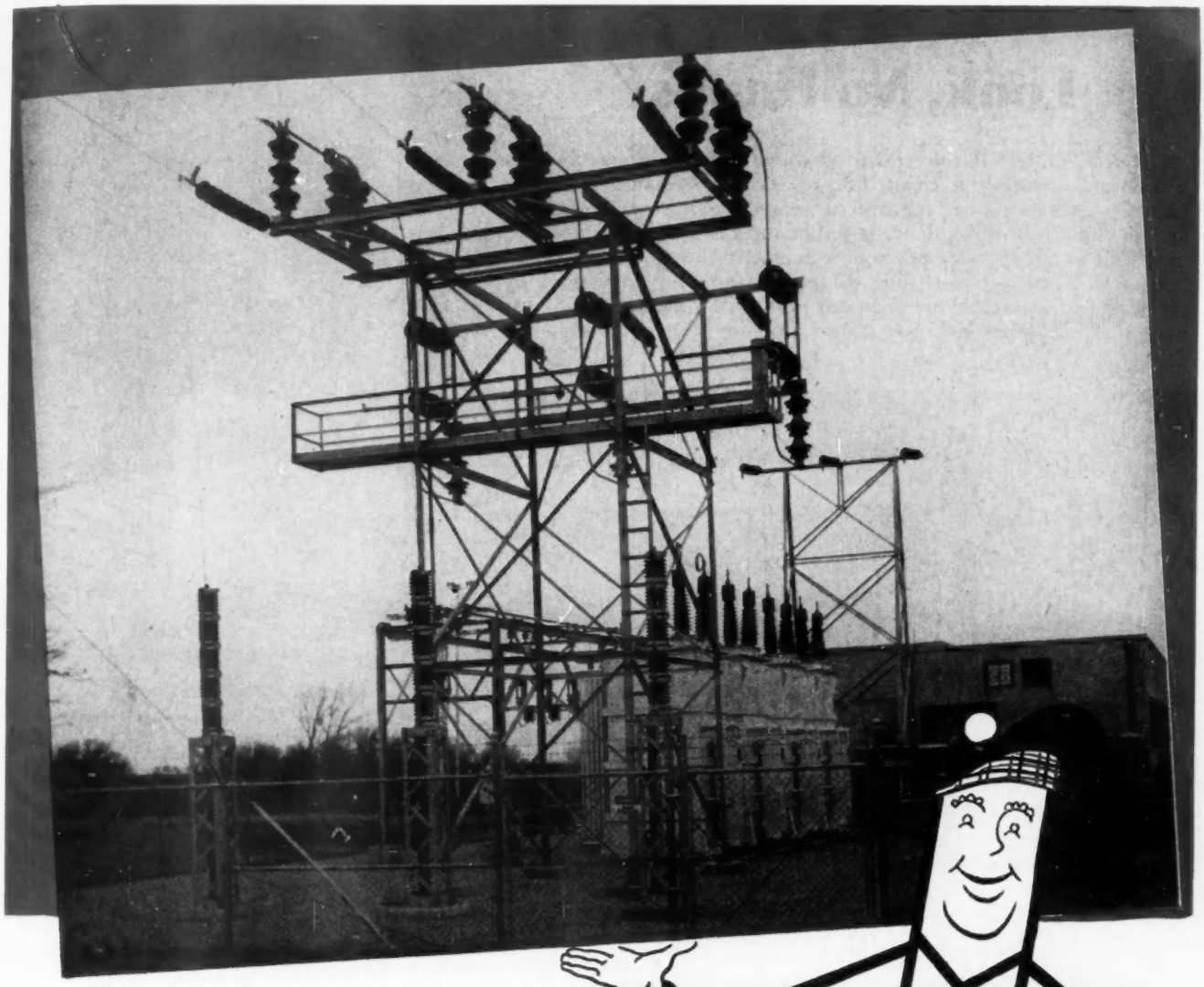
Three days after Christmas, December 28, Service Pipe Line made the first oil run in North Dakota—200 barrels from the Amerada-Iverson lease.

Through January, a Service Pipe Line gauger plowed through the snow to the tank batteries and turned them into the new gathering system. Fortunately the North Dakota crude has a high API gravity (around 40) and a low pour point, so the oil didn't freeze in the lines.

Gradually the two 5000-barrel tanks filled at the loading rack.

On February 12 a Great Northern Railroad locomotive hooked onto eight tank cars full of crude oil standing at the Service Pipe Line loading rack, and headed east. The first North Dakota crude oil was on its way to the refinery.

North Dakota producers could breath easier, and drillers could step up their drilling activity. They had an outlet for their oil.



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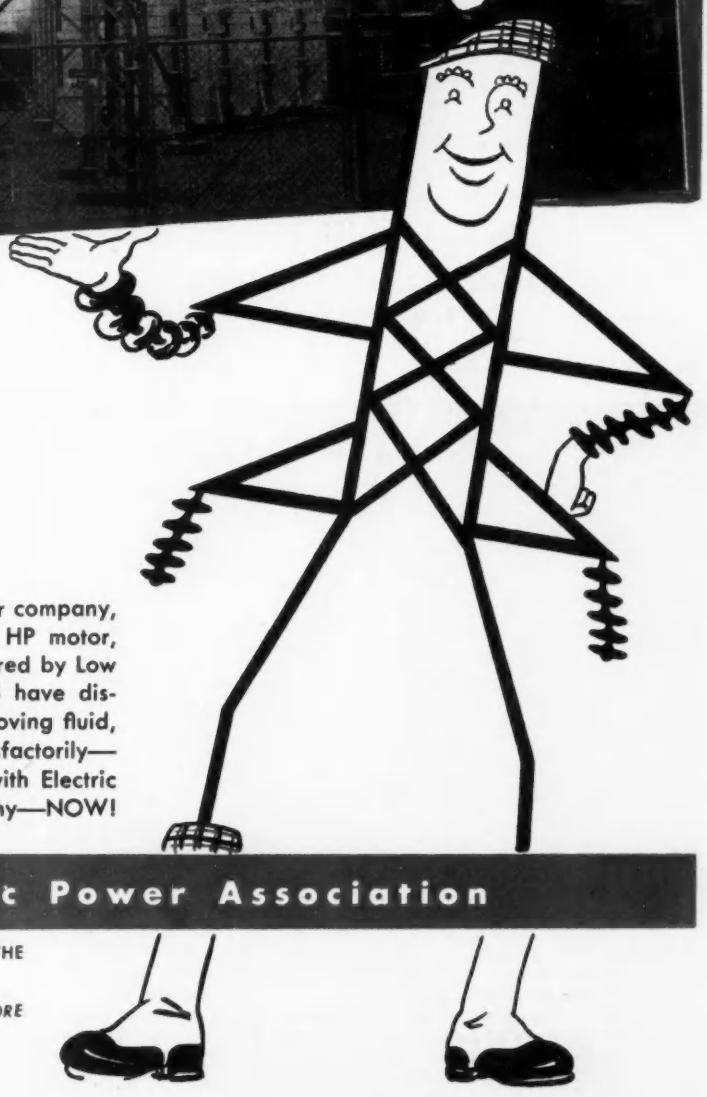
This Crude Pipeline Station, operated by a major company, in Osage County, Oklahoma, utilizing 1-1500 HP motor, 2-1250 HP motors and 1-750 HP motor is powered by Low Cost Electric Power. Yes, PIPELINE OPERATORS have discovered, regardless of the job to be done in moving fluid, that Purchased Electric Power can do it more satisfactorily—*and for less.* Simplify YOUR power problems with Electric Power. Call your nearest Electric Service Company—NOW!



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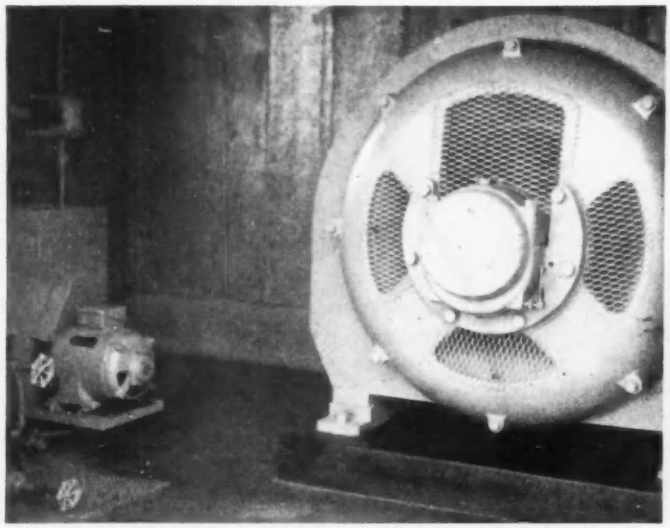
Look, No Hands!

AN AUTOMATIC electrically-powered compressor station has been operating at Egan, La., on Transcontinental Gas Pipe Line Company's system for over a year. The station handles 31 million cubic feet of gas daily. It scrubs the gas and boosts pressure from 800 to 925 pounds per square inch. At this pressure the gas flows into Transco's main line. Except for routine inspections by operators from a nearby oil company and regular maintenance visits from Transco personnel, the station operates totally unattended.

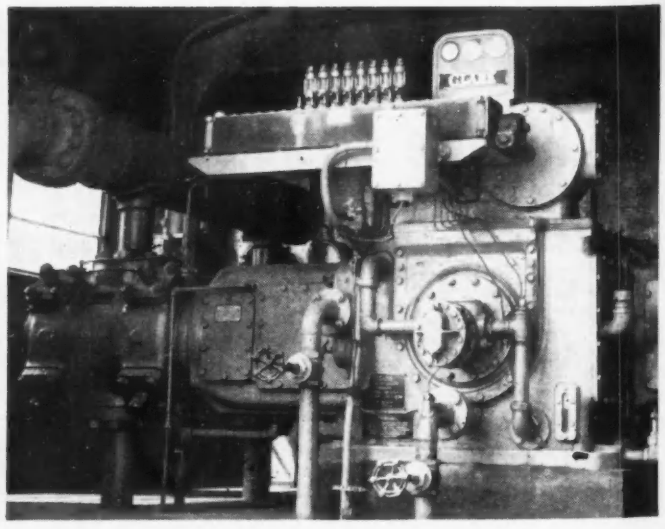
This station is located approximately four miles from Egan, a small settlement in south Louisiana. Gas from a nearby oil field enters the station through 35 MMCF scrubber at right. Maintenance crews from Transcontinental's Eunice, La., station make regular checks and repairs.

By L. L. NUNLEY

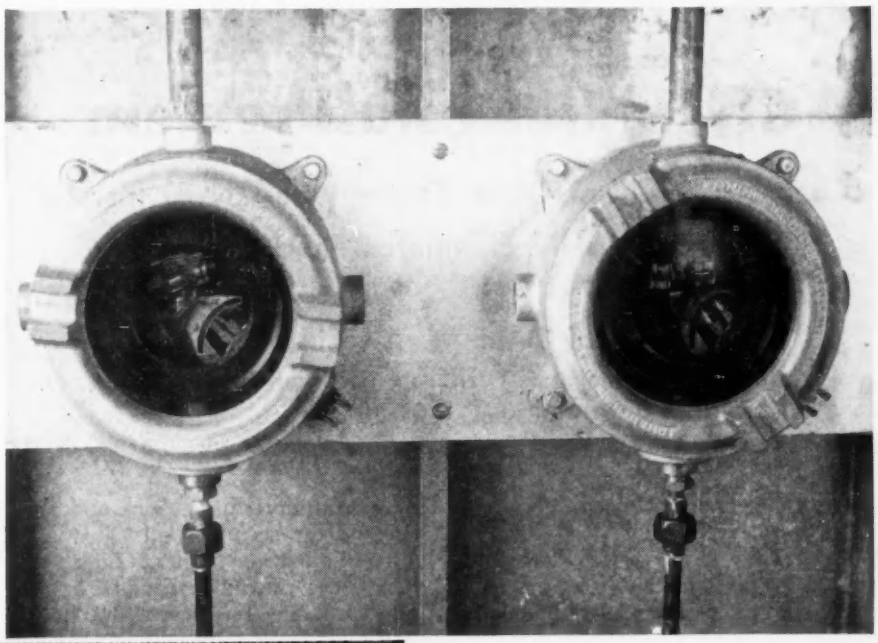
Transcontinental Gas Pipe Line Company
Eunice, La.



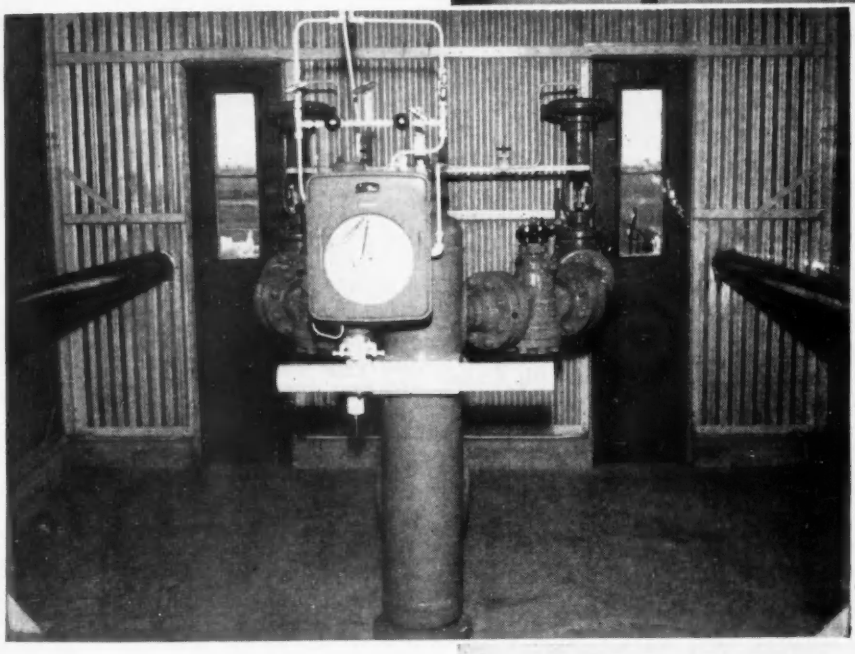
LEFT. Power for compressor is supplied by this 300-horsepower, 2300-volt AC electric motor. Shaft through vapor-tight partition in background links motor and reciprocating compressors. A carbon packing assembly in partition prevents gas from leaking from compressor room into motor room. Lube oil pump at left circulates oil through atmospheric cooler. Fresh air from outside building cools lube oil and ventilates motor room.



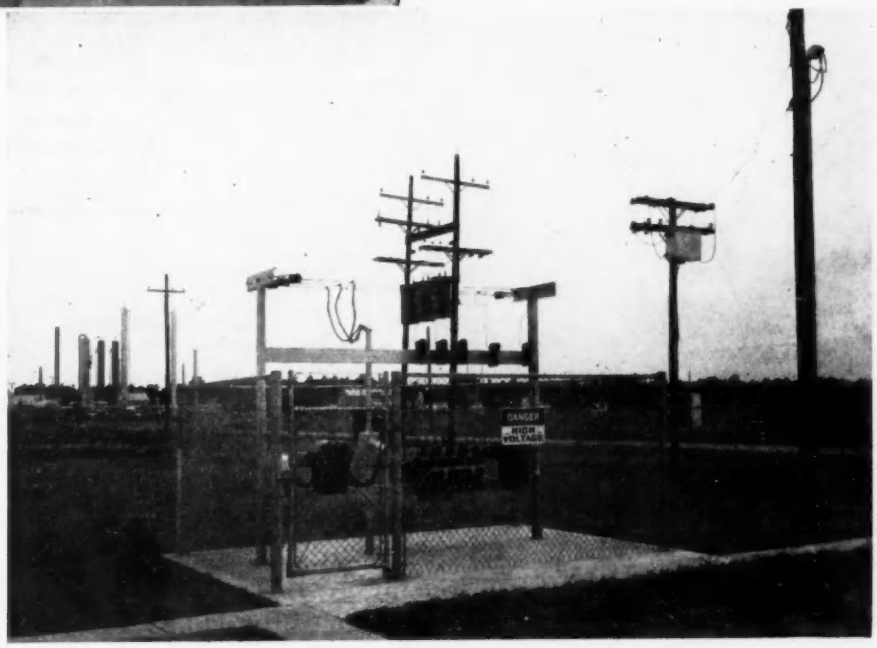
RIGHT. View of compressor room. Because of low compression ratio it is unnecessary to cool compression cylinders. Jackets of all cylinders are filled with oil to prevent hot spots and liberate small amount of heat generated by compressor.



RIGHT. Station is equipped with numerous protective shutdown devices. These two mercoids guard against high and low discharge pressure and low suction pressure. Other shutdowns are actuated by high liquid level in scrubber, high bearing and oil temperatures. Motors are equipped with conventional overload thermal trips.



LEFT. Gas control regulators on suction side of station prevent high momentary flow rates. This installation can be set to control flow or pressure.



RIGHT. Switch station. Difficulty was experienced during early operation when lightning caused surges on electric power lines to station. This was overcome by installing shield wire atop poles.

Glycol Solves a Problem

Charging Scrubbers With Diethylene Glycol Instead Of Oil Virtually Eliminates Fluid Carryover

By DALE W. ANSELL
Mountain Fuel Supply Company
Salt Lake City, Utah

MOSTLY carryover of scrubber oil can be easily eliminated. The answer is diethylene glycol. Trouble developed in a scrubber installation near Salt Lake City during the winter of 1949 and 1950. The scrubber would gain in oil volume, then lose nearly all of its charge. Finally the operational difficulties were traced to a gas source high in heavy hydrocarbon content. The heavy ends were going into solution with the oil. The increase in volume flooded the scrubber causing carryover. As an experiment the company charged the scrubber with glycol.

Line dust scrubbers were placed in operation at Salt Lake City and Ogden when natural gas was introduced into Utah in 1929. These were conventional oil contact scrubbers and for many years no operational problems developed.

Trouble first was encountered a few years ago with the two scrubbers at Ogden. Difficulty was experienced in maintaining the proper operating level of the scrubber oil. This difficulty was manifest both as high levels due to the pickup of fluids from the pipe line and low levels due to oil carryover from the scrubbers. In the latter instance, the scrubbers were often found to be nearly empty.

This oil carryover, which often amounted to a hundred gallons in a short space of time, caused continuous blowing drips, frequent meter changes and other service calls. Eventually the scrubbers were drained and became mere traps for pipe line liquids.

Meanwhile, no difficulties had developed with the larger scrubber at Salt Lake City. In 1949, the single line between Coalville and Salt Lake was paralleled, and the scrubber at the Salt Lake Border Station was replaced with an improved type having greater capacity. These changes imposed new operating characteristics on the system, the net effect of which was a sharply increased peak demand in the early morning.

Trouble developed within a few weeks after the new scrubber went on stream in October 1949. The difficulties were similar to those experienced at Ogden, with large amounts of scrubber oil being carried over into the city distribution system. Both high and extremely low oil levels occurred. The problem continued through this first winter, but even daily inspections failed to hold the oil level within reasonable operating limits. A typical analysis of the oil is shown in Table 1.

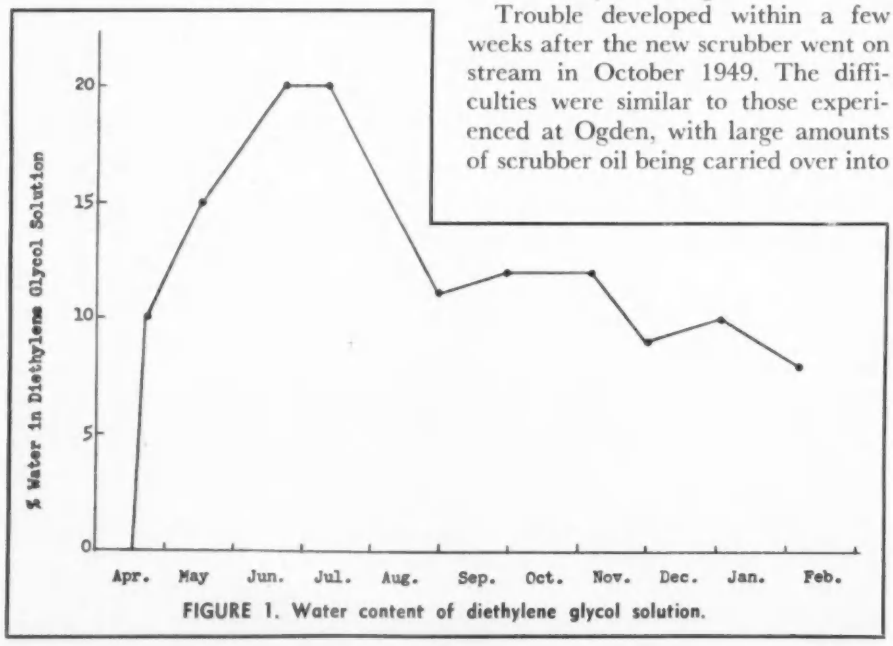


FIGURE 1. Water content of diethylene glycol solution.

Investigation revealed that hydrocarbons were being absorbed by the scrubber oil. This was a result of connecting the Church Buttes gas field to the system. Gas from this field contained a substantial quantity of the hydrocarbons above ethane. The quantity of these higher hydrocarbons in the gas from the other fields was relatively small. When scrubber oil absorbed these hydrocarbons the volume of oil increased until the scrubber was flooded. Excessive carryover of liquid resulted.

Later, lowered pressures released the more volatile hydrocarbons, and the liquid level dropped until it was too low for efficient scrubbing. These general conditions were aggravated by a high peak demand occurring in the early morning so that the highest and lowest daily operating pressures occurred within a few hours of each other, thus accelerating the loss of the more volatile hydrocarbons.

It was decided that a new nonabsorbing scrubbing liquid should be tried. Diethylene glycol was readily available, and it was possible to draw on experience in its use as a dehydrating agent. It was expected that this heavy liquid with its very low vapor pressure would serve effectively as a scrubber fluid. However, there was a question as to what quantity of water would be picked up in the summer when some of the field dehydration plants were shut down. If a large amount of water was picked up over a short period of time, the maximum operating level of the liquid might be exceeded. On the other hand, a more gradual pickup would tend to offset the normal vapor loss from the scrubber. A study of the conditions indicated that the amount of water pickup would not be excessive.

The scrubber went on stream with

TABLE 1
Typical Analysis of Oil Used in Salt Lake Scrubber Prior to April 17, 1950.

API Gravity	35.4°
Initial Boiling Point	494° F.
10 Percent Recovered	520° F.
50 Percent Recovered	556° F.
90 Percent Recovered	606° F.
End Point	645° F.
Total Recovery	99%
C.O.C. Flash Point	260° F.
C.O.C. Fire Point	295° F.
Olefines (Unsaturation)	10%
S.S.U. Viscosity (100° F.)	44
Color	Light Straw

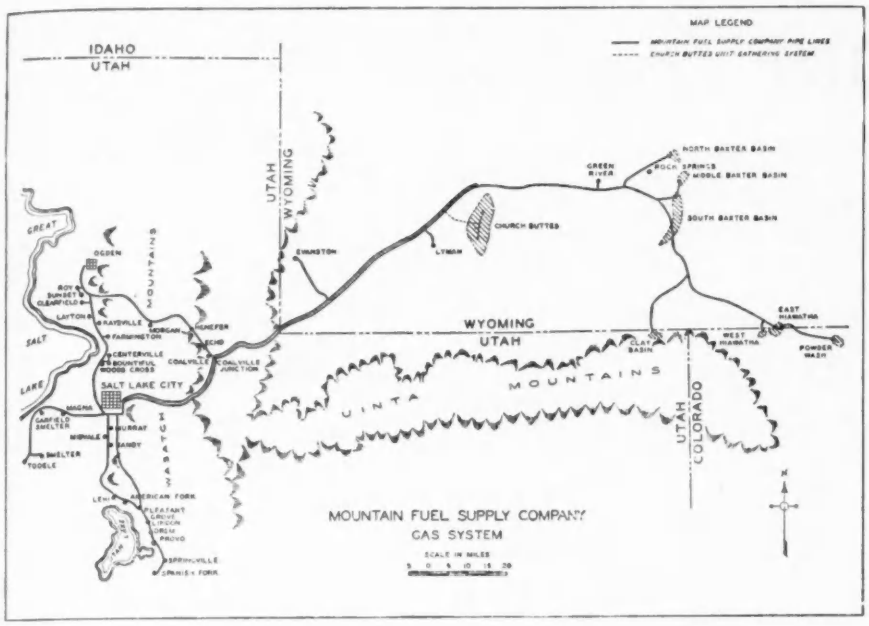


FIGURE 2.

a charge of diethylene glycol on April 17, 1950. As anticipated, the percentage of water in the glycol increased sharply at first and then more gradually until a maximum was reached toward the end of June when the glycol solution contained about 20 percent water, including a small undetermined quantity of complex organic solvent. Later, the percentage of water declined, apparently due to rising summer temperatures and lower operating pressures. This cycle is shown graphically in Figure 1.

The increase in volume of glycol solution made it necessary to withdraw some of the liquid during the first month of operation. After two and one-half months operation, it was necessary to add fresh glycol from time to time. The makeup rate varies with the load on the scrubber. During periods of peak demand, the makeup averages 0.042 gallons of diethylene glycol per million cubic feet of gas processed, but the average for a year is 0.034 gallons per million cubic feet (Table 2). These values are somewhat less than might be theoretically expected on the basis of vapor pressure calculations.

Judging by the amount of dust collected in the scrubber, diethylene glycol is an effective dust-wetting agent in this application. However, the finest particles of line dust tend to remain suspended in the heavy fluid instead of settling to the bottom of the scrubber. Thus, over a period of almost two years, the glycol has become quite dirty. This objectionable characteristic makes it necessary to clean the sight gages frequently. It appears that it may become necessary to filter the glycol solution every two or three years. Aside from cleaning the glycol the accumulated sludge on the bottom of the scrubber is removed about every six to eight months.

Since the scrubber has been operated with diethylene glycol, there has been, of course, no absorption of hydrocarbons, and the accumulation of hydrocarbon liquids has never reached significant proportions. However, in January 1952, about 250 gallons of absorption oil, carried over from the Church Buttes plant, collected in the scrubber. As a result, the scrubber was temporarily flooded. This problem was quickly remedied by skimming the immiscible absorption oil from the top of the glycol, and the scrubber was put back in service immediately. Appropriate action was taken at once at Church Buttes to mitigate the loss of absorption oil.

On the whole, the use of diethylene glycol in a line dust scrubber has been quite satisfactory. It is considered to be an effective solution to the problem of excessive loss of scrubber oil due to the absorption of hydrocarbons.

ACKNOWLEDGMENT

This article is from a paper presented at Pacific Coast Gas Association Technical Section, Technical Services Conference, Fresno, Calif.

TABLE 2
Vapor Loss from Sunnyside Scrubber.

Period of Operation	Vapor Loss of Diethylene Glycol Gallons per MMCF
November, 1950	0.045
December, 1950	0.038
January, 1951	0.043
Average for Period of Peak Demand	0.042
Average for One Year	0.034

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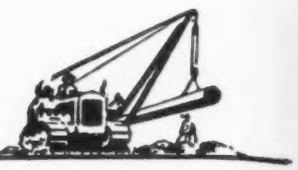
PIPE LINE *Construction*



Projects Announced and Contracts Awarded

Crude Lines

Consumers Refinery Association has received allocation of steel by PAD for the construction of 48 miles of 6-inch pipe line from the Platte system now building near Holdredge, Neb., to its cooperative refinery at Phillipsburg, Kans. The 5000 bbl. per day line is scheduled for 4th quarter completion.

Service Pipe Line Company has announced plans to extend its Williston Basin gathering system with 5¾ miles of 4-inch line. The new lines will connect the loading rack at Tioga, N. D. with newly opened production south of that point.

Product Line

Great Lakes Pipe Line Company intends to add 13 miles of 8-inch line to its system. The carrier will run between Potwin and Eldorado, Kans. and will be leased from the owner, Vickers Petroleum Company.

Natural Gas Lines

Carolina Natural Gas Corporation has applied to FPC for permission to construct 40 miles of pipe line from Transcontinental Gas Pipe Line Corp's line near Kings Mountain, N. C. to Rock Hill, S. C. Included were four service laterals.

Chicago District Pipeline Company has received FPC authorization to build 12.4 miles of 30-inch pipe line from Texas Illinois Natural Gas Pipeline Co's line near Elgin, Ill. to Public Service Co. of Northern Illinois' system at Oak Grove Township, Cook County.

Cities Service Gas Company has received FPC certificate to construct a 1100-hp compressor station in Oklahoma County, Okla.

Gas Lateral Company has FPC authorization to construct 6.8 miles of 8-inch pipe line from Texas Illinois Natural Gas Pipeline's system near Hoffman, Ill. to Illinois Power Co's system in Centralia, Ill.

Michigan-Wisconsin Pipe Line Company has asked FPC for permission to lay 18.5 miles of 6-inch lateral line from the company's system to Burlington, Iowa. Included in the request were 1.3 miles of 3-inch line linking two company lines near Maryville, Mo.

San Diego Gas & Electric Company made application to FPC for permit to construct a 1760-hp compressor station at Rainbow in San Diego County, Calif.

South Carolina Natural Gas Company has petitioned FPC for permit to lay a total of 160 miles of pipe line between Southern Natural Gas Company's line near Aiken, S. C. and Charleston, S. C. The system would be made up of: 30.8 miles of 16-inch, 93.4 miles of 12-inch, and 35.8 miles of 10-inch.

Tennessee Gas Transmission Company made application to FPC for 45 miles of 20-inch line to run between Buffalo, N. Y. and the U. S.-Canadian border near Niagara Falls, and which will be known as the "Niagara Spur." In the same request were 107 miles of 26- and 30-inch loops on existing lines and 50 miles of supply lateral lines. Also included were requests for 6 new compressor stations totaling 80,500-hp and installation of 51,500-hp additional in presently existing stations.

Wilcox Trend Gathering System, Inc., a newly formed concern, has made application with FPC for permission to construct 157 miles of 14- and 16-inch transmission lines and 60 miles of supply lines from the so-called Wilcox Trend fields of Lavaca, Jackson, Dewitt, Victoria, Bee, Goliad, Karnes, Live Oak, McMullen and Duval counties of the Gulf Coast and Southwest Texas to Eastern Transmission's system in Lavaca County. One 2200-hp compressor station would be installed.

Projects Started

Crude Lines

Ajax Pipeline Company, Ltd. has started 39 miles of 4-, 6-, 8-, and 10-inch line from Morinville to Edmonton, Alberta, Canada. Piggott Construction Alberta, Ltd., Edmonton, has the contract and expects to complete the job early in July.

Interstate Oil Pipe Line Company had Latex Construction Company of Georgia, Atlanta, start 22.5 miles of 8-inch line from the Cranfield field, Adams County, to the Mississippi River near Natchez, Miss. Same concern has awarded a contract for 3 miles of 8-inch and 17 miles of 4-inch near Natchez to Campbell Welding Works of the same city.

Platte Pipe Line Company had Rumsey Brothers Pipe Line Construction Co., Wichita, start 100 miles of 20-inch line from the Neb.-Kans. border to a point near St. Joseph, Mo.

Service Pipe Line Company started 26 miles of 10-inch line between the Saunders field, and the S Denton field, Lea County, N. M. early in June. Jim J. McCormick & Company, Wichita Falls, is the contractor.

Sinclair Pipe Line Company had O. R. Burden Construction Corp., Tulsa, get underway on 176 miles of 22-inch trunk line between Salisbury, Mo. and Forrest City, Ill. during May. Also started for Sinclair was a new pump station at Quincy, Ill., by Midwestern Constructors, Inc., Tulsa.

Product Lines

Buckeye Pipe Line Company started 75 miles of 16-inch pipe line between Linden, N. J., and Allentown, Penna. early in June. H. L. Gentry Construction Company, Jackson, Mich. is doing the job. Late in May Sheehan Pipe Line Construction Company, Tulsa, started 9 miles of 12-inch and 3 miles of 8-inch line near Monroe in Monroe County, Mich.

Shell Oil Company started 286 miles of 14-inch line between Wood River, Ill., and E. Chicago, Ind., early in June. R. B. Potanshnick, Cape Girardeau, Mo., is laying the line. The same contractor is taking up 320 miles of 8-inch along the same route.

Natural Gas Lines

Algonquin Gas Transmission Company in May had Williams Bros. Company, Tulsa, start 140 miles of 10,- 24-, and 26-inch line in N. Y., N. J., and Conn. Associated Pipeline Contractors, Inc., Houston, expected to get underway with 200 miles of 3-thru 16-inch line in late June. J. F. Fitzgerald Construction Company, Boston, started 10 miles of 24- and 26-inch in City of Waltham, Mass. for the same company.

Lake Shore Pipe Line Company started right-of-way work in May on 72 miles of 10-inch line from Tennessee Gas' line near Meadville, Penna., to Fairport Harbor, Ohio. Harford Bros. Pipe Line Construction Co., Emporium, Penna., is the contractor.

Michigan Gas Storage Company started 41 miles of 24-inch line between Rose Center and Laingsburg, Mich. during May. Mahoney Contracting Company, Lansing, Mich., is laying the line.

Natural Gas Company of West Virginia had H. L. Gentry Construction Co., Jackson, Mich., start work on 21 miles of 8- and 10-inch line between Lisbon and Sebring, Ohio during May.

Northeastern Gas Transmission Company started work on 100 miles of 16-inch line from the Conn.-N. Y. border near Greenwich to Springfield, Mass., and 125 miles of 3- thru 8-inch line in Mass. and N. H. Both projects are being built by Bechtel Corp., N. Y. C.

Northern Natural Gas Company late in May started 20 miles of 16-, 20-, and 26-inch loops between Guymon, Okla. and Hugoton, Kans. Arey-Phillips Construction Co., Pampa, Tex. is the contractor.

Tennessee Gas Transmission Company has started a program of constructing 525 miles of loop lines and addition of 93,900-hp on its system. Contractors and their jobs are: Oklahoma Contracting Co., Dallas, 117 miles 30-inch in Tex.; Houston Contracting Co., 39 miles 30-inch in Tex., 58 miles 30-inch in La., and 29 miles 30-inch in Ark.; Anderson Bros. Corp., Houston, 70 miles 30-inch in Miss., and 37 miles 30-inch in Tenn.; Western Pipeline Constructors, Austin, 32 miles 30-inch in Tenn., 27 miles 30-inch and 21 miles of 26-inch in Ky.; H. C. Price Co., Bartlesville, 83 miles of 26-inch in Ohio.

Projects Completed

Crude Lines

Edmonton Pipe Line Co. Ltd. has completed 12.5 miles of 6-inch between Armena field and Joseph Lake field, Alberta, Canada. Canadian Pipe Line Construction Co. Ltd., Edmonton, built the line.

The Texas Pipe Line Company completed 220 miles of 22-inch from Houma, La., to Port Arthur, Tex. Work was done by Houston Contracting Co.

Natural Gas Lines

Georgia Gas Company completed 32 miles of 4-inch from Transcontinental's line near Bogart to Gainesville, Ga. M. L. Hulcher, Inc., Virden, Ill., was the contractor.

Texas Eastern Transmission Corporation completed 217 miles of 30-inch trunk line from the Ohio River to Connellsville, Penna. Anderson Bros. Corp. laid the line.

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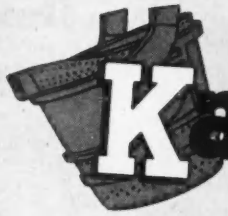

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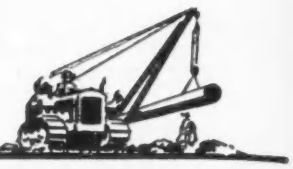

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Drainage Culverts Used as Supports

Drainage culverts, filled with concrete, support two six-inch pipe lines high above the bed of a West Texas Creek which has been dammed and will soon become a lake.

When plans for damming the creek were announced, it became necessary to relocate the two lines crossing it. An aerial suspension was decided upon, and engineers came up with this ingenious and inexpensive crossing.

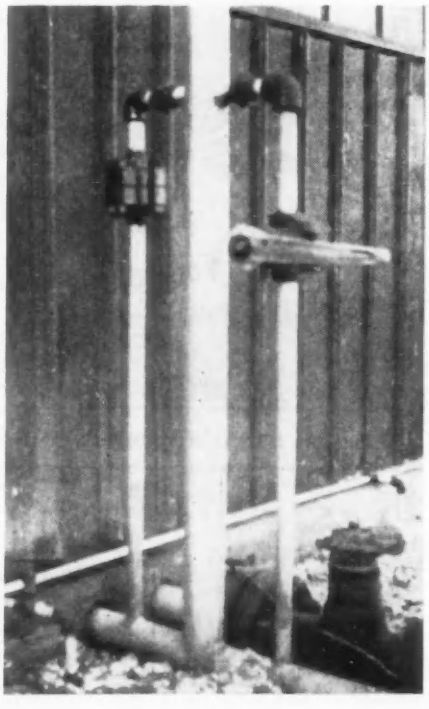
Ordinary deformed galvanized culvert pipe was used as a form for making concrete piers. Below ground, the excavations were carried deep enough to provide necessary resistance to overturning moment and then the culvert pipe was set on top of the excavation. A 55-gallon drum with a home-made trap door bottom was used in filling the culvert pipes. The drum was filled with concrete and hoisted over the pipe. The trapdoor was opened and the concrete ran into the forms. Sufficient steel was added to give the piers strength to withstand predicted loadings.

The central portion of the span had to be supported by a small pipe line suspension bridge. Two piers were poured on opposite sides of the creek bed. Upright, X-braced bents made of four-inch pipe were set down into the piers at the time of pouring. Then a 7/8-inch wire rope was threaded across tops of the piers and anchored on each side. These supporting guys were attached to the pipe lines as shown in the illustration.

Vents Built on Discharge Lines

At one pipe line station, small diameter compressor vents were installed on discharge lines leading from the individual compressors. The line itself was used as a base for the vent, which is braced to the compressor building.

To erect the inexpensive vent stacks, a length of line pipe was tack-welded on top of the discharge line. The stack and discharge line were connected with two small lines as shown. One of the small lines is used to blow down the compressor, while the other serves as a relief line with a burst plate clamped between two flanges. The top of the stack reaches well above the compressor building.



Device Retrieves Sample Thief

A device which will retrieve sample "thiefs" accidentally dropped in storage tanks can be made of a short length of one-inch pipe and eight or ten pieces of heavy bronze or copper wire.

Sample thiefs, used to determine the amount of basic sediment and water in bottom of storage tanks, sometimes come loose from the gauging tape, and fall to bottom of the tank. Because the presence of the "thief" in the tank can lead to errors in subsequent BS&W gauging, and could possibly get into suction from the tank, it could be retrieved.

A handy retriever can be fashioned from a one-foot length of one-inch pipe and non-sparking brazing rod or

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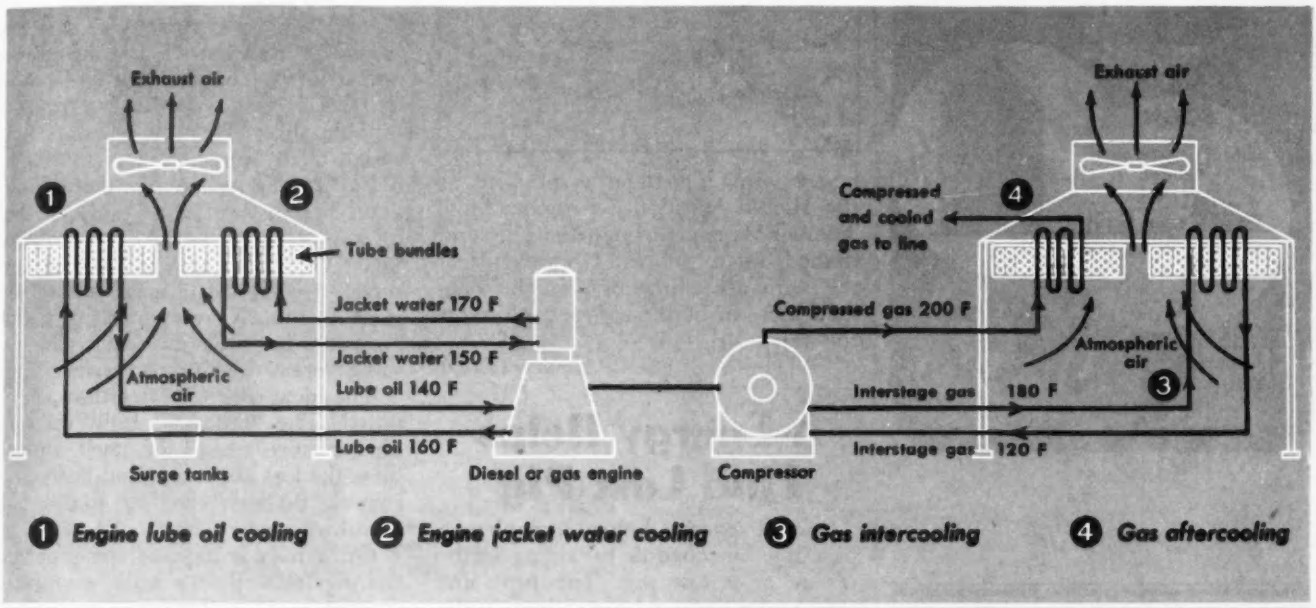

in high-pressure gas compressor stations

In a typical high-pressure gas compressor station, two ALCO Aircoolers shown in the illustration perform four major cooling duties: (1) engine lube oil cooling (2)engine jacket water cooling (3) gas intercooling (4) gas aftercooling.

Versatile ALCO Aircoolers are particularly effective in this type installation because they are designed to give long, efficient performance. Such troubles as scale, costly water treatment and other cooling problems are eliminated.

The heart of the ALCO Aircooler is the ALCO fin tube, which provides an extended outside surface for maximum heat transfer efficiency, coupled with low air-flow resistance for economy in operation. A continuous helically wound copper fin is bonded to the tube with lead-tin alloy, and the external tube surface is coated with this alloy to improve atmospheric corrosion resistance. The entire unit is quickly and easily assembled in the field.

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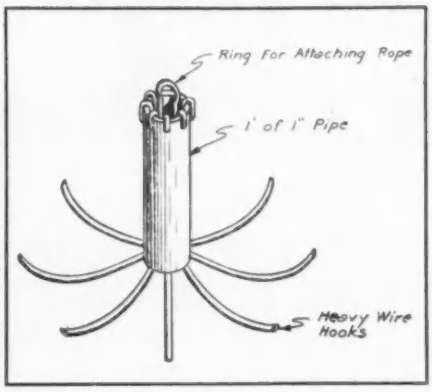

heavy wire. The lengths of wire or rod should be about 18 inches long. The wire is run through the pipe and fanned out as shown. Upper ends of the wire are crimped over the one-inch pipe, or bent to form a hook for the retriever.

A-Energy Helps Find Lost Pig

Atomic energy helped complete a pipe line on schedule by aiding in the rescue of a lost pig. The pipe line scraper was jammed somewhere in the newly completed Sarnia to Toronto products pipe line built for Imperial Oil Limited.

Final tests of the 12-inch line were going fine when a cleanout pig balked in a 13-mile stretch of pipe line just west of London, Ontario.

Faced with the two-fold problem of finding the lost pig and cutting the 12-inch line open to free it, pipe line engineers thought of the increasing industrial use of radioactive isotopes to trace elusive substances. An SOS brought them 300 millicuries of "hot" cobalt-60 by plane.

Putting the radioactive metal inside another pig, they sent it into the line in front of a strong head of air pressure. The second scraper, they reasoned, would stop right behind the jammed one. A super-sensitive radioactive counter would mark the spot to cut open the line to retrieve both.

The idea worked better than anticipated. The "hot pig" built up such air pressure ahead of itself that it blew the lost one loose, and both went roaring through the line like a pair of subway expresses.

On a hilly section of the pipe line the pigs slowed to a walk, giving the counter crew a chance to trace their

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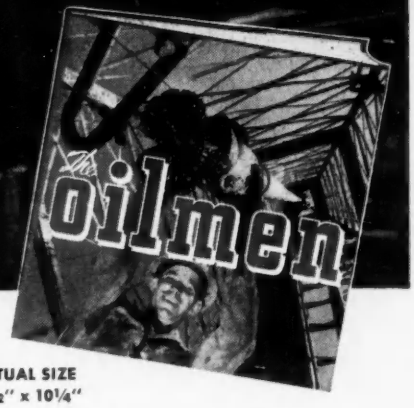

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Shell Oil Company and its employees co-operated with Mr. Hollyman to make this picture story possible—and offer this announcement as a service to the men and women who have made oil the nation's No. 1 source of energy.

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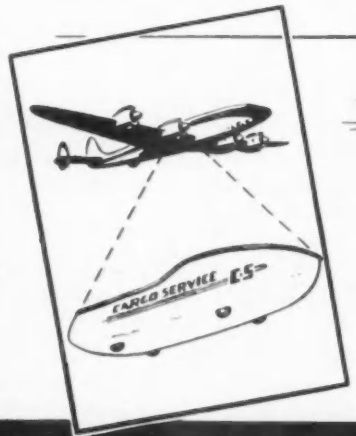

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progress. But they covered the last three miles in six minutes flat.

Just 22 hours after the "hot pig" went to work, the two scrapers boomed out of the pipe line's London end. Three days later the first shipment of gasoline went into the line at Imperial's Sarnia refinery destined for London, 65 miles away.

Pipe Protects Turning Lights

A short length of five-inch pipe fitted over trailer stop and turning lights protects them from damage. Such protection is especially important on trucks that are used in rough work.

The guard is made by welding a short half section of five-inch pipe over the row of lights after they are mounted on the end of the trailer bed. Circular holes are cut over the tail light and stop light lenses. Arrow-like slots cut into the pipe over the direction signal lights cut down on cost of these accessories. An ordinary red lens can be used instead of the more expensive lens which has a moulded arrow.

The mounting is simple. Just inside the clearance reflectors is the directional light, and inside that, about eight inches apart, are the tail and stop lights. The nipple is cut from a section of scrap pipe and split lengthwise in the center, so that one nipple can be used to cover all six lights on the truck. The nipple is then bent to fit down inside the channels of the bolster and welded fast.

Winch Is Added To Heavy Truck

By adding an additional winch and extending the ginpole of a heavy duty truck with an oil field bed, one company made an excellent truck for unloading pipe. When not being used for this service, the truck can be used to haul floats or pole trailers. This winch raises and lowers the specially reinforced ginpole boom on back of the truck.

This added winch remains on the truck while it is being used to haul floats, etc. The boom or stinger is made of four-inch pipe and braced with a three-inch leg, which prevents the boom from falling back over the cab of the truck when loads are suddenly released. This brace can be extended as the boom is lowered and when the boom comes to vertical position, a spring minimizes shock and prevents the boom's overbalance.

The base of the boom is fastened by running a three-inch nipple through loops in the bottom of the three four-inch sections. Loops are welded to the back of the truck bed to receive the three-inch nipple. A telescoping stand is fastened to the ends of the three-inch which folds down and is adjusted to take the load when heavy pipe is being loaded. When it is necessary to use the truck for other purposes, the three-inch nipple is removed and one pin removed from the brace and the winch lines rolled up.

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How to Keep the Gate Locked

Fixing responsibility is a sure-fire way to keep the pipe line station entrance gate locked. When several locks are used on one chain around the gate post, each key-holder knows it is his duty to keep the gate fastened. Keys may be distributed to construction crews, ranchers, production men and others who are authorized to come on the properties of the pipe line company, as well as station personnel.

In the case illustrated, the pipe line superintendent and the tour operators of the plant have a lock. Another is assigned to the rancher and his farm boss, while still another lock is used by the producing company which has a well on the lease where the pipe line station is located.

J. W. SHARMAN

Announcement . . .

Mr. Earl Allen, President of Associated Pipe Line Contractors, Inc., takes pleasure in announcing the election of

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Vice-President

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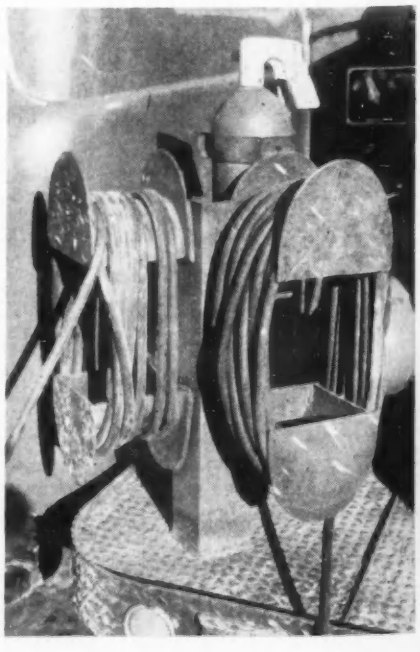
Novel Cable Rack Easy to Build

Welding cable racks of slightly different, but efficient design are used on the truck of one pipe line maintenance crew. The racks, mounted on an upright piece of angle iron welded to the truck bed, are made of short sections of casing to which have been welded flanges of ¼-inch steel plate.

Shown installed, the individual rack units may be made easily merely by welding the flanges, as single oblong plates, to the pieces of casing, after which the units are cut apart and separated the desired distance before welding to the upright post. Mounted in this manner, with each rack set at 90 degrees from the other, cables are easily wound up. The post may be positioned at any convenient place on the truck bed.



Panorama view of El Centro camp and headquarters.

De Mares - - A Free Enterprise Triumph

Benefits to Colombia Will Mount As It Operates Newly-Returned Concession Reconditioned by Tropical Oil Company

By J. MURRAY WALKER

Lane-Wells Company

AS TROPICAL Oil Company slips into the pages of oil history, its job done, the Columbian government is turning to the task of operating the De Mares Concession with an impetus furnished by the former concessionaire in the waning years of its contract.

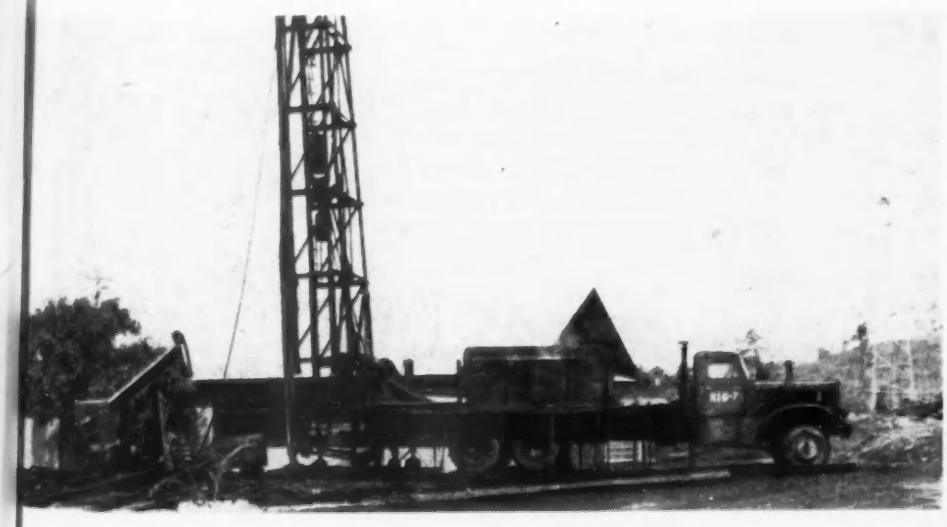
Tropical began active development in the De Mares Concession in 1921 under a contract which terminated last year, marking the first time in petroleum industry that a developed property of this nature has reverted under terms of the agreement to the government which originally granted the concession.

But it was in 1946 that Tropical, with less than five years of ownership remaining, embarked on one of the most outstanding and unusual records of modern oil production.

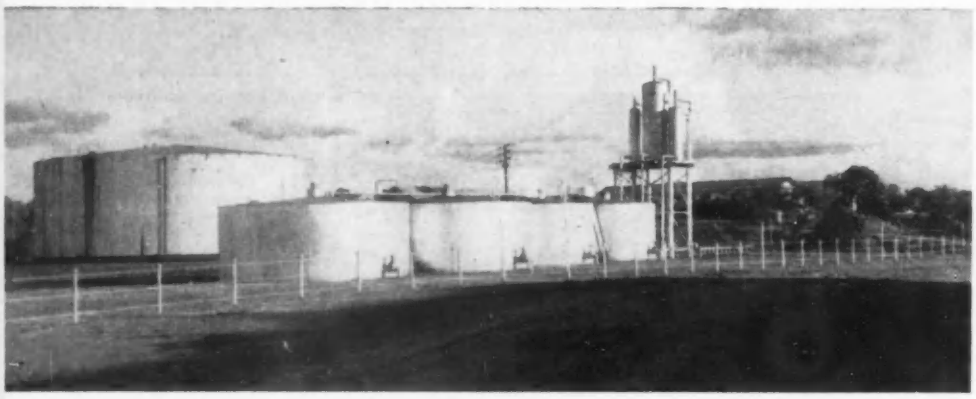
This program, which through remedial and recompletion efforts arrested a natural decline in production and increased De Mares yield without any new drilling, created a widespread appreciation for the methods of operation and cooperation which this privately-owned company employed in its relations with a foreign government. Tropical's continuing interest in a field with which it is no longer connected and a government with which it did business for many years has done much to partially arrest the growing trend in some foreign countries that would deny, if it continues, such mutually-benefiting arrangements.

In the post-war period, when a favorable annual production rate began to decline and most of the likely area had been drilled, Tropical initiated a reevaluation which resulted in the start of a reconditioning program. Plans jelled in 1947 were necessarily short range and flexible; existing records were of little initial help. However, old drilling logs were studied, electrical logs reinterpreted, experimental gamma ray logs correlated with other data, gun perforating records aligned with the study, and pipe practices reviewed.

While enlightening, these data pointed up the lack of many more. One factor, though, enabled the program to move with little difficulty into the second stage: no exceptional



Tropical Oil Company's cleanout rig 7.



Tank farm near Tropical pump station.

conditions of pressure, temperature or depth had to be considered.

Evaluation of geological data allowed the sifting of significant facts from the multitude on hand. De Mares Concession, situated in Departamento de Santander, is highly faulted anticlinal structure running north and south, and the principal feature of the producing field is the large fault along the eastern boundary. Producing section of La Cira-Infantas area, about 410 miles upstream from the mouth of the Magdalena River, contains an alternating and somewhat inconsistent series of oil-bearing and water-bearing sands which have been grouped arbitrarily into A, B, and C zones, with C zone the lowermost. Original completions were made in the better-developed sands of the section, and reconditioning and/or recompletion work was concerned primarily with the recognition and opening of other productive sands bypassed originally.

In some earlier wells, the oil string was not cemented. In most wells, the string was cemented only through the lower portion of the penetrated section so that most of the sands being opened in the reconditioning work did not have the benefit of cement protection. Many initial completions were made by opening only a part of the available productive horizons because of high production rates, possible high gas-oil ratios and incomplete knowledge of zone extent.

Technical work of organizing specific jobs for the program, which had to be designed, developed and completed before August 25, 1951, which was to end Tropical's concession, fell to the petroleum engineering department. Lack of electric logs, with erratic sand conditions, faulted nature of reservoirs and lack of cement protection behind casing forced work to be conducted on well to well basis and precluded formulation of a long-term program for the field.

That cementing was to play a major role in the program was evident from the start: if upper zones were unprotected, squeeze jobs to protect them would be required, in addition to isolating interbedded water sands which were not shut off, plugging off depleted sands which threatened to become thief zones, separating zones if intercommunnication would prove troublesome.

Gun perforating was used in all recompletions, usually on 24-inch spacing, instead of the usual 4-inch interval. A 3⅝-inch gun was adapted to fire downward, primarily for breaking up cement retainers or other plugs to save cleanout time. Conversion of this gun was based on information obtained from a similar project in Talara, Peru. Tropical completed the entire program using only three sizes of guns—3⅝-inch o.d., 4-7/16-inch o.d., and 5¼-inch o.d.

Fourteen inactive C zone wells were recompleted to B zone producers in 1947 to save drilling of B zone wells. Their total production for that year was 111,200 barrels. While some drilling was still in progress during the year, reconditioning appeared to offer greater possibilities of arresting field decline or perhaps increasing production than new drilling.

26 Workover Jobs

Twenty-six workover jobs were completed by adding productive sands to zones already being produced for an initial gain of 286 barrels a day, an average of 11 barrels per well. Assuming these wells produced an average of six months of the year and that their production gains declined 25 percent for the remainder of the year, they added approximately 45,000 barrels to 1947 production.

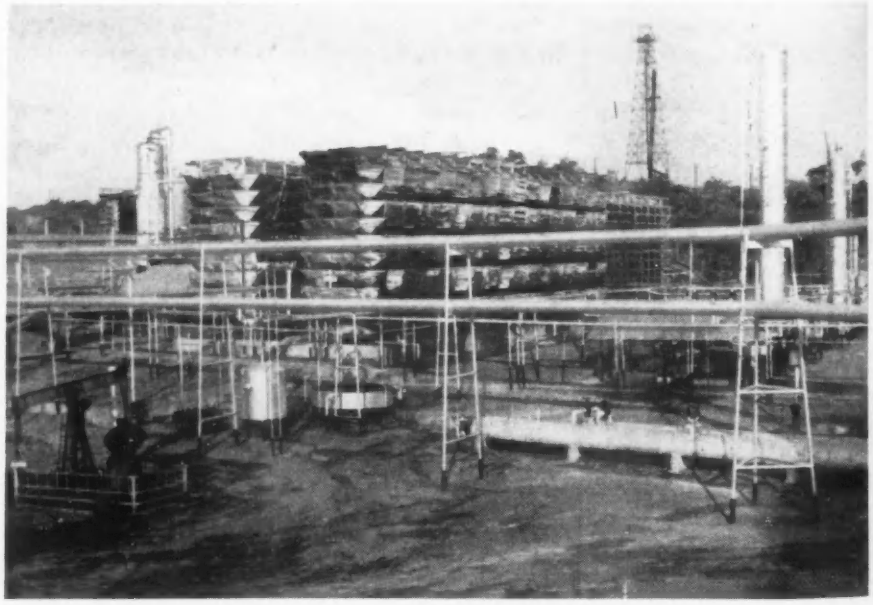
About 156,200 barrels of additional oil was produced in 1947, purely as a result of reconditioning. No allowance was made for 17 other workover jobs performed on gas injection wells, and the shut off gas and water sands in producing wells which afforded no production gains. (Table 1.)

During 1948, 76 reconditioning jobs were completed, excluding water and gas injection workovers, for an initial daily production gain of 668

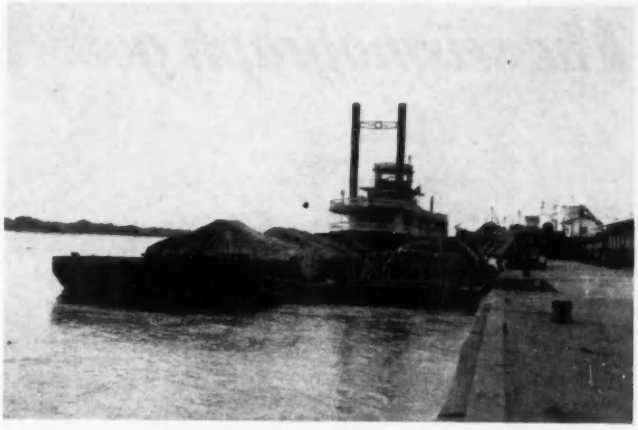
TABLE 1

Production Gain from 1947 Workovers
(Barrels per day)

	1947	1948	1949	1950
As of December	690	518	440	396
Average for Year	428	604	479	418
Percent Decline	.....	25	15	10
Total Barrels	156,000	221,100	174,800	152,600



Gasoline plant and compressor station at El Centro.



LEFT. Catalina pumping installation.
RIGHT. Barges on Magdalena River at Barranca-Bermeja, near Tropical's refinery docks.

barrels, 489 barrels and 1060 barrels for the first half, third quarter and fourth quarter of the year respectively. An extrapolation was performed, using initial production gains as starting points, and, with the help of reasonable declines for remainder of the year, it was found that on December 31, a production rate of 1870 barrels a day was obtained from the reconditioning jobs completed during 1948. (Table 2.)

Particularly significant was 1949 because the production decline was reversed, and the increasing trend was sustained. Tempo of activity rose markedly during the year as 209 reconditioning jobs were completed, with initial production gains of 1344 barrels, 1752 barrels, 2069 barrels and 3101 barrels per day for the four quarters of the year. (Table 3.) Gun perforating again performed a major role in the program.

At this point, workovers began providing a more complete record. Additional new data allowed the projection of the program further into the future, and the better selection of areas for reconditioning offered almost assured success.

But the most outstanding production increase was accomplished during 1950, when a major step in facilitating correlation of data on individual wells and speeding up reconditioning jobs was taken. On the basis of analysis of previous experimental gamma ray logs, two gamma ray survey programs including 177 wells were made in 1950 of wells lacking electric logs. These logs greatly decreased the amount of "blind" work and promoted recognition and elimination of some minor water sands from the completion intevals.

During the year, 357 wells were reconditioned and initial production gains of 1762 barrels per day and 5370 barrels per day were obtained during the last two quarters, respectively. High initial gains reflect exceptionally good results obtained from recompletions to the A zone—58 sands along the west and northwest of La Cira field. About 80 wells were recompleted or worked over in the A zone from August to December. This group of wells added about 7000 barrels daily to the December, 1950, De Mares Concession yield. Again, Tropical credited its gun perforating units.

13 New Wells Drilled

In addition to the reconditioning program during 1951, (Table 4), final year of Tropical's control in De Mares, 13 new wells were drilled in the A zone and produced an average of 2275 barrels daily. Their accumulated production to August 25 was 213,900 barrels. These wells were drilled as a result of favorable reconditioning work in the western section of La Cira, where the sands of the A zone were better developed. These sands had not been heavily produced and were not believed to be particularly productive.

And so it is that Colombia has gained full advantage of the concession's revenue-producing potentialities which have been raised to a significant level and which Tropical expected to extend far beyond the concession's expiration date. This was possible only through the long-term planning so unselfishly brought to a successful completion by a producing company whose job is ended.

ACKNOWLEDGMENTS

The author is indebted to various staff members of Tropical Oil Company in Bogota and El Centro, Colombia, where most of the material for this article was obtained. The willingness of management, both in Toronto and Bogota, to cooperate fully and make available for study many files and company records is gratefully acknowledged. In particular, the author wishes to thank the following Tropical Oil Company personnel for kind treatment and much help in the assembling of the material for this article: V. R. Rose, Paul Ratliff and Paul Tucker of the Bogota staff; M. M. Briscoe, Joe Philpot, Joe Murphy, A. J. Wacker, I. T. Chapman, S. Cadavid, William Koch and many others in El Centro.

TABLE 2
Production Gain from 1948 Workovers
(Barrels per day)

	1948	1949	1950
As of December	1870	1403	1193
Average for Year	679	1636	1298
Percent Decline	.....	25	15
Total Barrels	248,700	597,100	473,800

TABLE 3
Production Gain from 1949 Workovers
(Barrels per day)

	1949	1950
As of December	6,729	5,047
Average for Year	2,929	5,888
Percent Decline	.....	25
Total Barrels	1,069,000	2,149,100

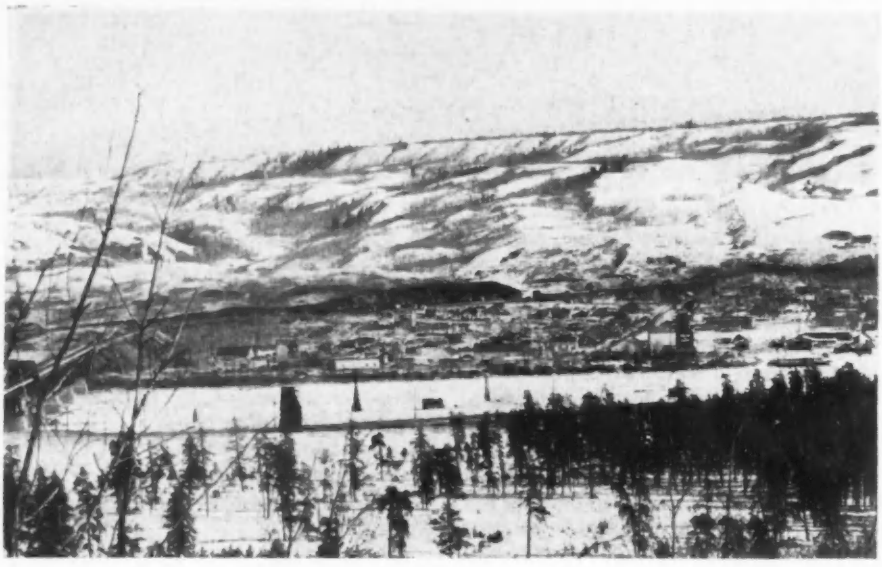
TABLE 4
Production Gain from 1951 Workovers
(Barrels per day)

TYPE OF JOB	Wells	Before	After	Total	Production Barrel Per Day Gain Per Well
Plug Back and Open Different Zone (Recompletion)	13	160	380	220	17.0
Open Different Zone	13	424	866	442	22.8
Plug Back and Increase Open Interval (Workover)	4	45	92	47	9.4
Increase Open Interval in Same Zone	12	537	959	422	35.1
Cleanout Jobs (Producing Wells)	13	352	561	209	16.1
Total (Excluding Cleanout Jobs in Water Injection Wells)	55	1,518	2,858	1,340	23.1

The seismograph goes North

No. 1

This is the first in a series of articles describing the movement north of seismograph exploration in the continuing effort to discover oil beneath the Arctic muskeg.

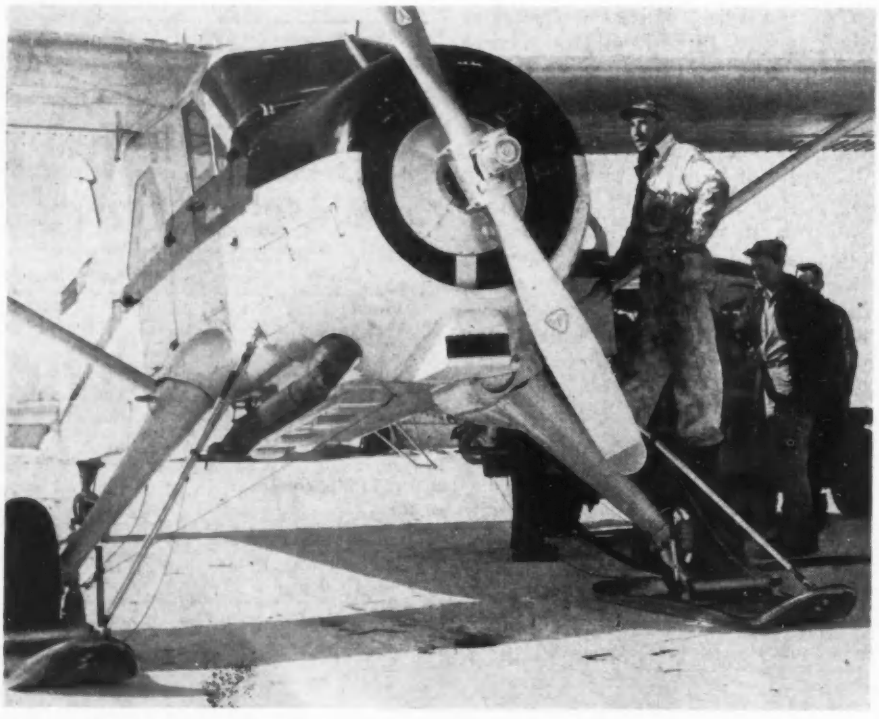


Peace River, Alberta—booming on speculation.

By JAMES JOSEPH
Bureau Chief
Western Round-Up
Los Angeles

Peace River Booming

With Wheat in Its Granaries and Oil on Its Mind, Alberta Town Is Prospering on the Coat-tails of Geological Expectations



This Standard Oil Company of California airplane and many others jam the Peace River airport.

PEACE River may have wheat in its granaries but it has oil on its mind.

As springboard for seismograph crews jumping off into the far northern Canadian muskegs, this Alberta town is bulging at the seams. And after two years of exploration activity, too.

Oil men from almost every major producing and exploration company are crowding in. Shacks once empty —and due for wrecking—are demanding sizable rentals. Hotels and the town's few motor courts are filled with year-around guests. A local pub, a chief after-work attraction for oil men, is jammed—and congenial.

Before oil men came, Peace River's population was 1000. In two years it has jumped to 2500. And local census takers have stopped counting.

Yet Peace River's boom-town profile is contradictory. Edmonton, astride highways leading to the big Leduc and Redwater oil discoveries,

Drilling rigs lumber through Peace River almost 24 hours a day.

Parking space? A driver is lucky to find it in Peace River.

is prospering. Calgary, headquarters for many companies operating in Western Canada, is taking on the appearance of a Canadian "Tulsa." But no real oil or gas discoveries have been found around Peace River. Its growth stems from raw hope.

One-Well Field

Whitelaw, 40 miles west, is a one-well field, despite its discovery in August, 1950. Normandville, 50 miles southeast and a 1949 discovery is another one-well field. The Athabaska tar sand deposit, west of Peace River, still baffles petroleum scientists seeking a method for extracting its heavy oil.

Potentials? Yes. But they're unusual oil boom material.

Peace River is probably the world's only community—certainly Canada's —flushed to prosperity on the coattails of geological expectation. And expectation grows as each new seismographic crew rolls out of town, bound for the northern muskegs. Chief distribution center for the Yellowknife mining area and for MacKenzie River trappers, Peace River town has through the impetus of sheer geography become chief supplier for the muskeg oil explorers.

The editor of the weekly Peace River Record-Gazette (circulation 3000) shakes his head and says, "If they ever do strike oil here, or up in the muskegs, brother! What'll we look like then!"

But Peace River town is too absorbed right now to worry about tomorrow. Imperial Oil Ltd.'s 40-man organization is operating in the showrooms of a local machinery dealer. California Standard Oil Company of California has headquarters—and a few well-furnished rooms for visitors —in an unpainted, two-story building a few blocks away. Stanolind Oil and Gas has taken over a Main Street store that may have been a farm house once.

Still They Come

Streaming into the town is an endless procession of wheeled and tracked vehicles. They converge in a kind of mechanized squeeze-play. Pressing down from the northern muskegs are harried and weary work crews, free on 10 days' rest leave. Riding in from the south by plane, train and by car are muskeg-bound returnees, their respite from jug-lines and bush camps ended. Behind them follow truck convoys, bringing up reinforcements of

Motor vehicle repair shops in Peace River are doing land office business.

Building on right was built by Standard of California for its employes.

Stanolind Oil Company camps out in this one-time store on Peace River's main street.

This is Peace River's Town Hall and Royal Canadian Mounted Police office.

seismographic supplies, food and prefabricated houses.

Peace River's theater used to show one film nightly; now it has added a second. A once fledgling ski club has more members than it can handle. Three new apartment buildings are going up. But they're already under five-year leases to Imperial Oil, Ltd. The local airport, a few miles west of town, is lined with oil company planes. Main street cafes, once overstocked and under-patronized, are operating full blast.

Mercantile establishments have profited handsomely. The Canadian Bank of Commerce is building new offices on Main Street. The Provincial government has approved construction of a block-long unit to house the Treasury Branch Bank and a handful of other provincial offices. The McNamara Hotel just opened 10 new rooms, some with baths. And down the street a pool hall partitioned off its second story, turned it into a dozen bedrooms.

The local telephone company, which now stays open 24 hours a day, hasn't found time to publish a new directory. The old one is sadly outdated by the daily arrival of new companies determined to set up offices, despite the lack of space.

R. H. Sawyer, one of two local barbers, said, "This town would close up like a fan if the oil companies moved out. Half my business is from oil staffers and crewmen now. So's the business of everybody else in town."

And then, flourishing a pair of clippers, he motioned across the street where a cafe was turning customers away. "See what I mean?"

152 Geophysical Parties

Down Peace River's Main Street cavalcades of trucks churn bumper to bumper. There are 152 geophysical parties working in Western Canada. Sixty-three are headquartered at Peace River. Add to these surveying crews and the diesel parties—about 100 in all—and you've got some idea what oil prospecting means to Peace River. Then there are manufacturer's representatives, seismographic suppliers, and the offices of contract geophysical companies. Someone suggested at a town meeting once that a sign be posted at the outskirts of town, "Full Up—Sorry."

Residents are daily reminded of the approximately $2.5 million which is being thrown into the muskeg search every month. A lot of that money flows through Peace River town—and some of it sticks.

Some townspeople, of course, remember the days before oil. Their memories wouldn't have to be long. Then, the town was a quiet community of 1000, nestled in a canyon-like valley scooped out by the meandering, often turbulent Peace River. In earlier days the river violated its banks and cut a deep gorge for itself. And it dug a townsite several hundred feet below the broad wheat lands which comprise the famous Peace River Block. The Peace River country is about 300 by 400 miles in area, but grain-growing is confined to a 225 by 150 mile block in its center. The entire area lies some 200 miles northwest of Edmonton in the latitude of Labrador. Yet, it is Canada's most northerly, important grain-growing region. Settled by its championship wheat and construction of the Alaskan Highway.

But Peace River town today is a blooming paradox. And seismologists may confirm the calculated guess that big pools of oil lie beneath the Arctic muskegs.

They began two years ago. The end is not yet in sight.

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KINGDOMS OF OIL—NO. 14

SIGNAL HILL, CALIF.

By MARTIN VAN COUVERING

Petroleum Engineer and Geologist, Glendale, Calif.

This 1924 view shows a Signal Hill well beginning to blow out of control.

A MAJOR oil company's chief geologist for the Western Hemisphere sped from South America to the United States in 1921 to stop a "damned fool" from discovering the second greatest oil field of California.

But he failed.

And Signal Hill has since produced 757 million barrels of oil from exactly 1558 acres. An average recovery per acre of almost a half million barrels.

At the turn of the decade, the city of Long Beach and its 75,000 inhabitants hugged the Pacific shore. Unlike many other oil kingdoms before discovery wells were brought in, oil was not unknown. Huntington Beach's cluster of 70 wooden derricks was 12 miles down the coast. A small number of wells had been drilled at Beverly Hills oil field in the Fox Hills district.

Atop Signal Hill, then a squared-off town-lot subdivision, were residents who bought the lots for the sweeping view, raised chickens and vegetables. The lots were small, but they were to become potent.

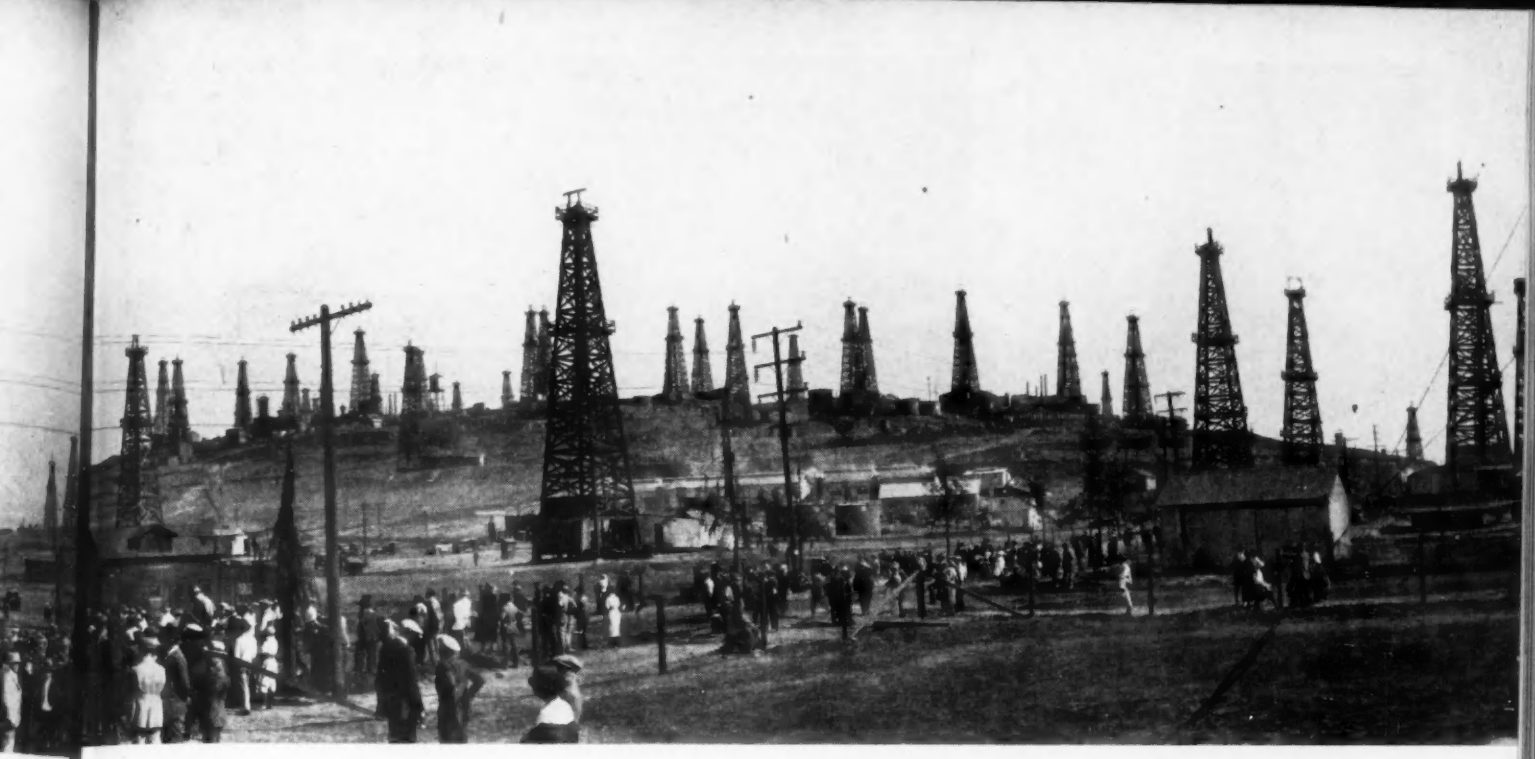
And nobody had to wait very long. For on June 25, 1921, as the clock dialed out 4 a.m., Signal Hill oil field blew into existence. And woke up the chickens which began eating and the residents who began counting.

Shell Oil Company's Alamitos 1 was 3114 feet deep when it began producing 500 barrels a day. Later deepened to 4631 feet, Alamitos 1 produced to 1952 692,000 barrels of oil.

All because Dr. W. Van Holst Pelekaan, Shell's chief geologist, failed to reach the drilling site in time to stop the well begun by Geologist Alvin T. Schwennesen. Dr. Pelekaan's opinion was backed by top geological thinking of the day, too.

And now, because of a trip that took too long, the city of Long Beach surrounds Signal Hill and extends far to the north. Population has risen to a quarter million. Census-wise, Long Beach is the 41st city in the nation.

Thirty years later, Signal Hill was



Panoramic view of blowout at Shell Oil Company's Andrews 3, on March 29, 1923. Blowing out of control in the morning, the well was successfully capped by midnight. The well flowed at 40,000-barrel-a-day rate through both drill pipe and casing, and was one of the largest wells on the Hill. This view is looking east, with Cherry Avenue in background.

Because It's a Long Way from South America to the U.S., California's Second Greatest Field Was Born Back in 1921 To Produce 757 Million Barrels of Oil From 1558 Acres

yielding oil at a rate of about 8 million barrels yearly from 1170 producing wells.

Thirty years ago Schwennesen spudded in a rank wildcat in opposition to top technical and grass roots opinions. Geologists were unmoved by the prospects. Five years before, a dry hole was drilled near Atlantic Avenue, two miles northwest of the discovery well. The failure was drilled to 3449 feet. Not deep enough at that site.

The Shell test was not influenced by its relation to Signal Hill; otherwise, it probably would have been drilled on the Hill. It had been thought for some time that the area of accumulation beneath the Hill would not extend west of Cherry Avenue, an arbitrary western boundary.

Few wells had been drilled in the area before this illusion was smothered, Jan. 1, 1922, by 10,000 barrels of oil a day. This crude was furnished by General Petroleum Corporation's Black and Drake 1, more than 1000 feet west of Cherry Avenue.

By this time, blowouts were common. Most of them were gassers.

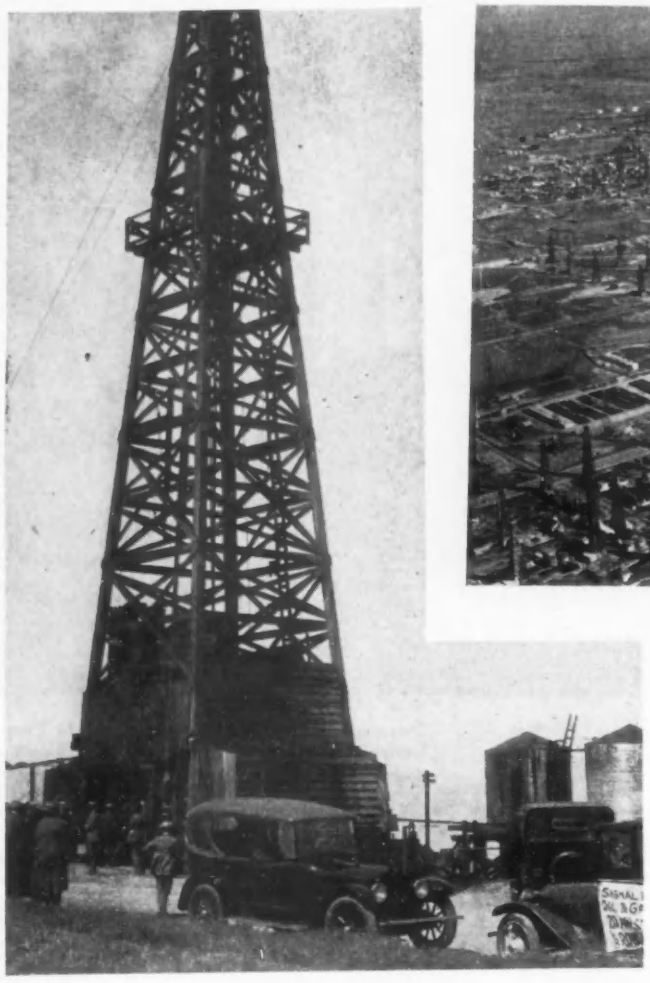
And stepouts were common, too. Especially farther to the northwest along what then was recognized as the probable trend of the productive area. First of these pioneer wells was Cal-Mex Oil and Refining Company's 1, completed in August, 1922, and situated at the intersection of California and Anderson streets, almost a mile west of the Black and Drake well.

At the close of 1922, the oil field was about three miles long. Herwick 7, at Linden and Frankfort Streets in the northwest part of the field, helped extend it.

The field underwent a secondary boom with an extension to the northwest in the residential suburb of Los Cerritos. Hundreds of wells were drilled, but their average productivity never matched that of the main field.

Signal Hill epitomizes town lot drilling. Probably no other field was so influenced by small, individually-owned parcels of land. The field was developed in the easy-money era. At a time when enforcement of State Corporation Department regulations was in its infancy. Actually, promoters'

This photo taken in 1921 shows Shell's Martin 1, near top of Signal Hill, shortly after blowout.



ABOVE. A general view of Signal Hill and Long Beach field at the end of 1929. By this time more than 300 deep wells had been drilled, some of which penetrated producing formations at more than 7500 feet. In background on right is Pacific Ocean.

LEFT. This is Shell Oil Company's Alamitos 1 discovery well, which touched off one of the most intensive townlot drilling booms ever experienced in California. This photo was taken the day after well was brought in.

activities at Signal Hill speeded the growth of this enforcement.

Wells on small triangular tracts at street intersections cluttered the Hill. One of these barely had room for the derrick and equipment. It was advertised as the smallest lease in the world. Yet, it found oil.

But the close spacing led to troubles. Insufficient space for operating equipment. Storage tanks were too close to open fires beneath boilers. Inflammable gas issued from wells, sumps, etc. Trespassing was common. Holes were intercepted by competitors. It was unheard of. It was outlandish. It was Signal Hill. Where a man could jump from one derrick floor to another to bum a cigarette.

But progress and Alexander Anderson's directional survey was to correct that proximity problem. This invention first bore fruit when the more progressive operators began studying ways to straighten holes as they were drilled—to avoid trespassing and lawsuits.

Then it dawned on operators that holes might be deflected deliberately. Unfortunately, initial attempts to do it were largely illegitimate. Prolific production from the field's center was too strong a lure for some. So they built derricks along the southern margin of the field and whipstocked wells northward.

That didn't last. Lawsuits forced abandonment of many wells. And hole deflection later became an art with many legitimate uses.

Signal Hill is a field of many zones. Discovered from top to bottom. And a 1928 discovery resulted in another boom which spilled over into 1929 and just about equalled the original field.

Ill-defined, the zones are a rapid succession of relatively thin bodies of sand and shale. But aggregate thickness of pay sand is fantastic, running into thousands of feet in some sections. It probably accounts for the exceedingly high recovery of about a half million barrels per acre.

Lovelady Pool, on the southern flank of the structure, is perhaps the most famous area in Signal Hill field. It contained several 10,000-barrel-a-day wells.

The effect of Signal Hill on world markets was complicated by the fact that it did not stand alone. During the flush of its first boom, Huntington Beach and Santa Fe Springs oil fields, also in the Los Angeles Basin, were producing a tremendous amount of crude.

Santa Fe Springs nearly equaled

About the Author

MARTIN VAN COUVERING has been a consulting petroleum engineer and geologist for 30 years. He was a petroleum engineer for the State Division of Oil and Gas when Long Beach oil field was discovered. In 1922, he went into private consulting practice in that field at the time of its most active development. Van Couvering was graduated in 1916 from Oregon State College with a B.S. degree in mining engineering. In 1941, he studied at University of California at Los Angeles and obtained an M.A. degree in geology. He has served in public capacities, including membership on the Committee on Petroleum Economics of the Federal Oil Conservation Board.

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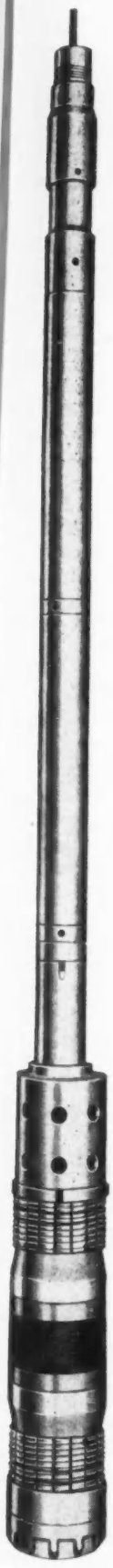

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Baker Retainer Bridge Plug

LEFT. Derrick floor scene of typical steam-driven drawworks used in early days at Signal Hill.
RIGHT. This photograph taken in March, 1931, from crown block of well near top of Signal Hill shows closely-spaced derricks.

This is the top of Signal Hill about mid-1928. In that year, field produced 62,467,103 barrels of oil, second best year in its history. Record year was 1923—68,810,361 barrels.

This monument was dedicated May 3, 1952, at site of Shell Oil Company's Signal Hill discovery well, Alamitos 1, by Petroleum Production Pioneers. Left to right are: W. F. Sharp, W. I. Parker and C. H. Cupernell, who worked on Alamitos 1; S. F. Bowlby, Shell vice president; Mrs. D. H. Thornburg, D. H. Thornburg, Shell geologist who surveyed Long Beach area in 1920, and J. W. Elder and M. B. Schumacher, also Alamitos 1 crew members.

Signal Hill, except in total production. This vast oil reservoir played hob with prices.

But the law of supply and demand won. The price of 27-gravity Signal Hill crude fell from $1.90 a barrel in August, 1921, to less than 70 cents at the close of 1923. And in October, 1923, Signal Hill reached its peak daily production of 244,527 barrels.

The price recovered quickly, and stood at about $1.50 a barrel early in 1925. The boom of 1928 and 1929, again paralleled by a spurt in Santa Fe Springs activity, had less ill effect on prices.

Signal Hill will long be remembered for another far-reaching influence: it was the birthplace or proving ground for much mechanical equipment and many technological procesess.

Directional surveys, electric logs, weight indicators, steel derricks, mud control, blowout preventers, improved coring, advanced micro-paleontology and special types of drilling bits. These and many other improvements stood their first trial by fire at Signal Hill.

Signal Hill has gone down in oil history. Its authors were many. William C. McDuffie, Bill Reinhardt, "Happy" Yowell, Joseph B. Dabney, A. T. Jergins, R. R. Bush, George F. Getty, J. E. O'Donnell, Walter H. Fisher, Tom J. Cannon, E. B. Campbell, "Art" Delaney, E. J. Miley, "Ed" McAdams and "Sid" Johnston. The list is longer.

And Signal Hill is not through. An incorporated city, it is still producing between 24,000 and 25,000 barrels of oil a day from 1170 wells. Drilling is continuing. But Signal Hill now is only adding to a history begun because a geologist couldn't get to California fast enough to prevent it.

ACKNOWLEDGMENT

For some of the data included in this article, WORLD OIL and the author extend their appreciation to *"The Wildcatters,"* a history of the American search for oil by Samuel W. Tait, Jr.

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Argentine Oil Supply Skidding

Under Peron, Nation Is Moving From Meatless Days to Oil-less Days; Government Stifling Its Own Crude Development By Manipulations

By ROBERT E. SPANN
WORLD OIL Staff

FINANCIALLY-distressed Argentina, once a major meat exporting nation, under the dictator rule of Juan Peron now has enforced "meatless" days because of shortages. Now it is heading rapidly towards possible "oil-less" days.

While crude production in 1951 moved slightly ahead of 1950 to a postwar high of 24,407,183 barrels, it was still less than peak production, reached in 1943 of more than 27 million barrels. With the only exploration for new oil in government hands, wildcatting has been extremely limited. Drilling has been largely confined to proven fields, with only enough additional production brought in each year to check the natural decline of older wells.

Despite the gradual rise in production since 1946, domestic requirements have grown at a faster rate. So now the nation depends on imports for most of its petroleum needs. Total imports last year were at a rate of 110,000 barrels daily, of which 60,400 barrels were crude. That was almost equal to domestic crude output, which averaged 66,864 barrels daily—up 2859 barrels daily over 1950.

Argentina production is in the hands of the government company, Yacimientos Petroliferos Fiscales (YPF) and five private capital entities: Astra Cia. Argentina de Petroleo (Argentine capital); Cia. Ferrocarrilera de Petroleo (British National Railways of Argentina); Cia. Rio Autel "El Sosneado" (Argentine capital); Diadema Argentina S.A. de Petroleo (Royal Dutch-Shell), and Standard Oil Company S.A. Argentina (Standard of New Jersey).

These privately-owned companies have been the victims of a series of government manipulations. The first dates back to an amendment to the 1935 Mining Code (petroleum law) prohibiting private capital operators from acquiring additional acreage for exploration unless the companies form a 50-50 joint company with the Argentine government, with the latter holding veto action on decisions. None has been formed.

With the postwar consolidation of dictatorial powers under the hand of Peron, the government has made a more indirect approach — though equally effective—to reduce the status of private petroleum operations. This has been through currency exchange controls, rigid restrictions on granting import licenses for oil field equipment and establishing YPF as the sole importer of crude and refined products.

Generally, it is impossible for a private company to import equipment from dollar areas. It may be obtained only through the government whose foreign trade, because of its acute financial condition, has reverted to the barter system. At present, the Peron government has such "swapping" deals—wheat for steel—with Great Britain, West Germany and Italy, with the latter supplying the limited volumes of oil field equipment allowed to be imported. And YPF has first call on available equipment.

So it is understandable why crude production has shown no substantial increase, though competent geologists rate Argentina's producing possibilities as "good," and why production of private companies has declined steadily in recent years.

The table traces this trend by producing areas. YPF last year accounted for 50,818 barrels daily, or three-fourths of the total. Eight years ago the government company's share was two-thirds of the total. In that period its total production has increased from 16,205,626 barrels to 18,548,505 last year. In the same period, the five private companies have shown a decline from a 1944 total of 8,024,273 barrels (one-third of the total) to 5,859,678 barrels in 1951.

No major discoveries of oil by private companies have been made since the small Ramos field (1951 daily

Argentina Crude Oil Production by Districts, YPF and Private Companies, for Recent Years

YEAR	COMODORO RIVADAVIA*		NEUQUÉN		SALTA		MENDOZA		TOTAL		GRAND TOTAL
	YPF	Private[1]	YPF	Private[2]	YPF	Private[2]	YPF	Private[3]	YPF	Private	
Prior to 1944	137,499,041	100,289,709	10,734,155	10,975,559	6,514,912	16,636,947	12,604,982	319,236	167,343,090	128,221,451	295,564,541
1944	10,226,615	6,875,895	1,923,249	445,005	961,366	682,081	3,094,396	21,292	16,205,626	8,024,273	24,229,899
1945	9,722,422	6,411,096	1,964,141	382,061	665,281	618,949	3,102,020	14,999	15,453,864	7,427,105	22,880,969
1946	8,747,176	5,680,285	1,936,628	343,962	466,586	556,074	3,063,475	8,214	14,213,865	6,588,535	20,802,400
1947	9,913,889	5,789,870	2,024,889	295,039	471,436	494,388	2,847,540	8,800	15,257,754	6,588,097	21,845,851
1948	10,532,228	5,781,416	2,429,902	304,801	503,464	513,835	3,178,318	8,762	16,643,912	6,608,814	23,252,726
1949	10,075,102	5,618,867	2,442,155	250,512	434,111	482,858	3,277,442	8,558	16,234,301	6,360,918	22,595,219
1950	10,657,786	5,471,313	2,311,120	224,432	376,402	427,805	3,884,740	8,103	17,230,046	6,131,655	23,361,701
1951	11,926,891	5,267,578	2,059,968	194,950	538,084	387,960	4,024,298	7,454	18,548,505	5,859,678	24,408,183

* Includes Yacimientos Petroliferos Fiscales (YPF) production from Cañodon Seco field in Caleta Olivia district since 1945. [1] Astra Cia. Argentina de Petroleo, Diadema Argentina S.A. de Petroleo and Cia. Ferrocarrilera de Petroleo. [2] Standard Oil Co. S.A. Argentina. [3] Cia. Rio Autel "El Sosneado."

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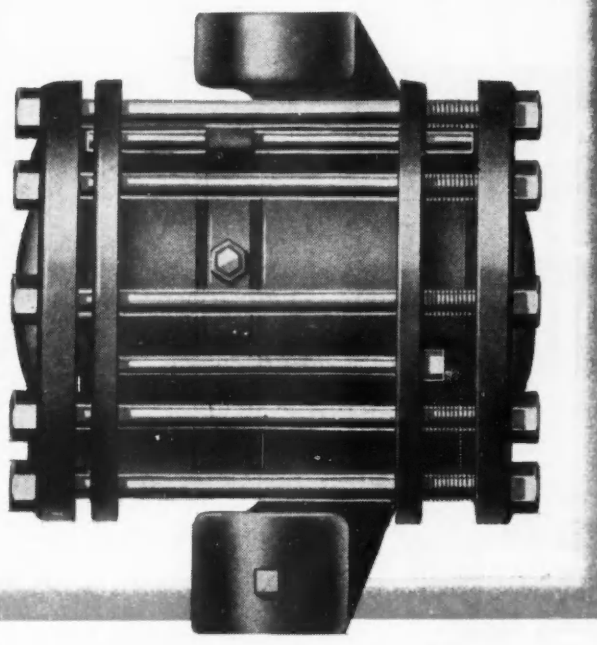

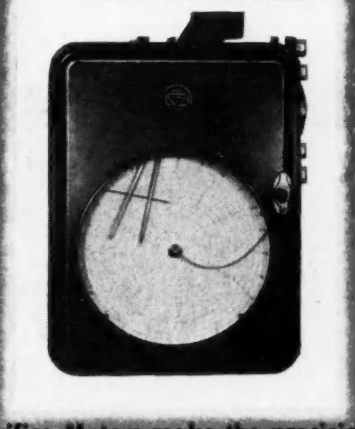

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average production: five barrels) by Standard Oil of Argentina in 1937, and YPF has not found a new field since Canodon Seco in 1945. The latter with a daily average output of 6649 barrels in 1951 has been the principal reason for YPF's increased output since the war. With the continued decline in production due to governmental restrictions, and other limitations at the marketing end which penalize private companies in favor of YPF, it is doubtful whether private capital will remain in Argentina much longer.

Early this year, The Texas Company and Socony-Vacuum Oil Company withdrew from refining operations with the forced sale to the government of their jointly-owned subsidiary, Ultramar S.A. Petrolera Argentina, which operated a 6000 barrels daily capacity refinery at Dock Sud in Buenos Aires and storage facilities of 2 million barrels capacity.

This plant was first forced to close down in 1950 after the Argentine government failed to grant additional dollar allocations for purchase of suitable Venezuelan crude. The decision to sell out to Peron was for inability to get foreign exchange allocations for crude for 1952. Argentina reported it will pay $5,355,000 for the properties to be paid in blocked pesos, a sum which the company discribed "at official exchange rates is something more than our depreciated original investment. Until we get the pesos out," it was added, "we will not know what, if anything, they will be worth."

Other producers and refiners in Argentina face similar circumstances. It has been hoped the exit of the owners of Ultramar would result in the Argentine government revising at least some of its policies applicable to petroleum operations. But so far no change has occurred.

Like the dictator countries behind the Russian "Iron Curtain," Dictator Peron permits no statistics to be released by government officials relative to petroleum operations, and most companies are reluctant to provide operating data. Through private contacts in Argentina, WORLD OIL has been able to assemble accurate production figures shown in the accompanying table, and based on these can deduct that YPF has made no new finds of oil of commercial nature, despite several claims by the government company over the past two years that new fields have been found.

Field Discovered

The Sowjetic oil administration in Austria has made a major oil discovery in Matzen, which is south of the older Zistersdorf production area, it is claimed in Vienna. The discovery at Matzen is credited to exploration work by Rohoel Gewinnungs AG. (Socony-Vacuum Oil Company and Shell jointly) before World War II. It is said the new wells of Matzen are already yielding about 30,000 barrels a day. Total production of the Austrian fields amounted to about 10,234,500 barrels (more than generally was anticipated) and may reach 12,281,400 barrels this year, the reports said.

German Test Finds Gas

The Wintershall AG. Rehden 4 discovered a high-pressure natural gas deposit in the Buntsandstone at 5825 feet. Located east of the village of Rehden, Germany, near Diepholz, the well was drilled as an exploration test with small diameter hole, therefore is not suited for commercial production. Wintershall will drill a second hole to exploit the gas deposit.

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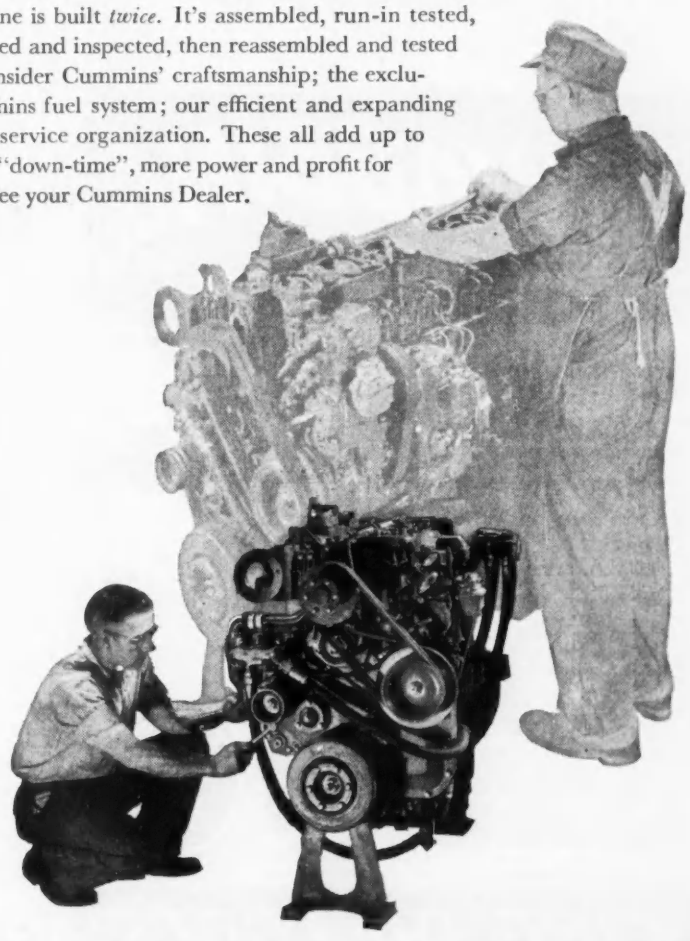

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Iranian Nationalization Argued at The Hague

ALMOST a year after Anglo-Iranian Oil Company was kicked out of Iran, an open hearing on the validity of the nationalization of the company's properties commenced before the 15 judges of the International Court of Justice at The Hague.

Technically, the sole issue before the tribunal last month was the question of whether the court has jurisdiction in the dispute between the British and Iranian governments. However, arguments by both sides reviewed in detail the history of relations between the concessionaire and Iran dating from the first contract in 1901. Differences arose over failure to agree on royalties through a revision of the 1933 agreement between AIOC and Iran which had until December 31, 1993, to run.

Negotiations to revise the financial terms of this compact were begun in 1949 and, with the best company offer described by Iranian leaders as "too little and too late," resulted in the March, 1951 vote to nationalize Anglo-Iranian properties.

Iran previously defied an International Court injunction on its nationalization proceedings. And prior to the June hearing Iran said it would not be bound by any "unfavorable" ruling. The hearing gave the government of Premier Mossadegh, financially and politically near its end, a final opportunity to arouse sympathy among other nations by renewing its charges that AIOC's operations were directly responsible for the poverty and lack of development in Iran.

Chief legal arguments on the technical issues before the court presented for the Iranian Government by its Belgian advocate, Henri Rolin, were:

- British objections to nationalization should not be heard on the ground that the British government and AIOC had accepted the principle of nationalization in Iran.
- British demands that the court consider compensation to be paid for AIOC's properties should be rejected since the company had never availed itself of procedures under Iranian law for establishing a claim for compensation and had not replied to an Iranian offer to work out a system of compensation.
- The court should recognize that the terms under which Iran accepted in 1932 the court's jurisdiction over disputes arising under international treaties and conventions explicitly remove from the court's jurisdiction disputes arising under treaties and conventions dated prior to 1932.
- The 1933 agreement between Iran and AIOC should not be termed a treaty.

The court was asked to rule that the act of nationalization falls within the domain of matters "essentially" within national jurisdiction as defined by the United Nations Charter and

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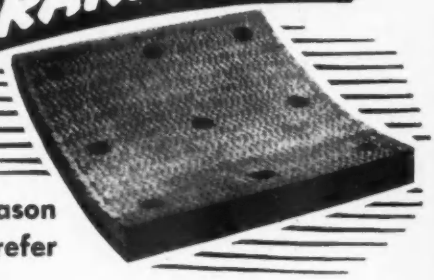

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is, therefore, outside the jurisdiction of the UN or its organ, the International Court.

British Chief Counsel Sir Eric Beckett refuted these points, maintaining his principal argument that the court was competent to judge the dispute since the broad issue was that Iran violated both contractual and treaty obligations by arbitrarily nationalizing the properties of Anglo-Iranian.

While legal arguments concerned the act of nationalization and the power of the court to rule on the merits of this action, Iran stood before the world as a nation which had destroyed its chief source of income. Subsequent to acquiring Anglo-Iranian properties, Iran had failed to sign a single contract for the sale of crude or refined products outside its borders with the exception of a sale to a ship for bunkers; one tanker load at the end of May to a ship flying a Honduran flag and listed as belonging to an Italian owner, Cia. de Navigacion Teresita, S.A.; and a contract to deliver 1.5 million barrels to Italian tankers for refineries in Italy. While Iran has produced small volumes of crude and operated the 2300-barrel daily Kermanshah refinery at near capacity for local demand, it has made no attempt to date to undertake substantial operations of the oil industry.

The severe loss so far has been Iran's alone. Anglo-Iranian in 1951, despite the closing down of its operations in Iran at the end of July, had total crude production (from Iran for seven months and from its share in output of Iraq, Kuwait, Qatar and in the United Kingdom) of 242,786,600 barrels, or only 65,941,400 barrels less than its 1950 total, which included Iranian output of 241,425,000 barrels. AIOC's output of crude in Iran through last July was 122,948,000 barrels. Total sales of crude and refined products by Anglo-Iranian in 1951, according to the company's annual report to stockholders, declined only 14.8 million barrels from 1950 to 270.1 million barrels.

Continued increases in crude production in other Middle East nations where AIOC shares, and enlarged refinery expansion program of the company throughout the world indicate that by the end of 1952 total crude output and refinery throughput of Anglo-Iranian will be at least equal to production and refining capacity of the company at the time of nationalization in Iran.

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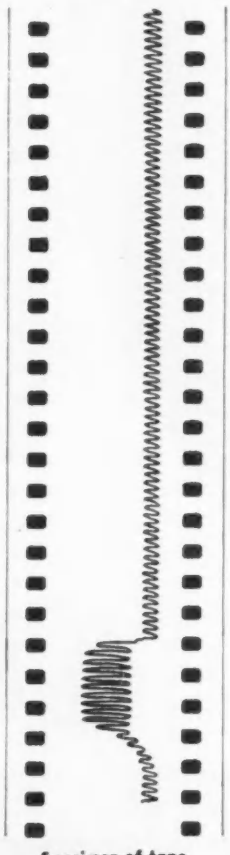


Specimen of tape indicating saturation

Barbados Gulf Spuds In Its First Island Test

Barbados Gulf Oil Company is drilling its first exploratory test well on Barbados Island following completion last year of aerial magnetometer, gravitimeter and seismic surveys. The company, a subsidiary of Gulf Oil Corporation, was granted an exploration license last year for a four-year period covering six parishes as well as territorial waters off part of the leeward coast. The total area is equal to about one-half of the island area. Barbados, a member of the Windward Group of the Lesser Antilles, covers 166.2 square miles.

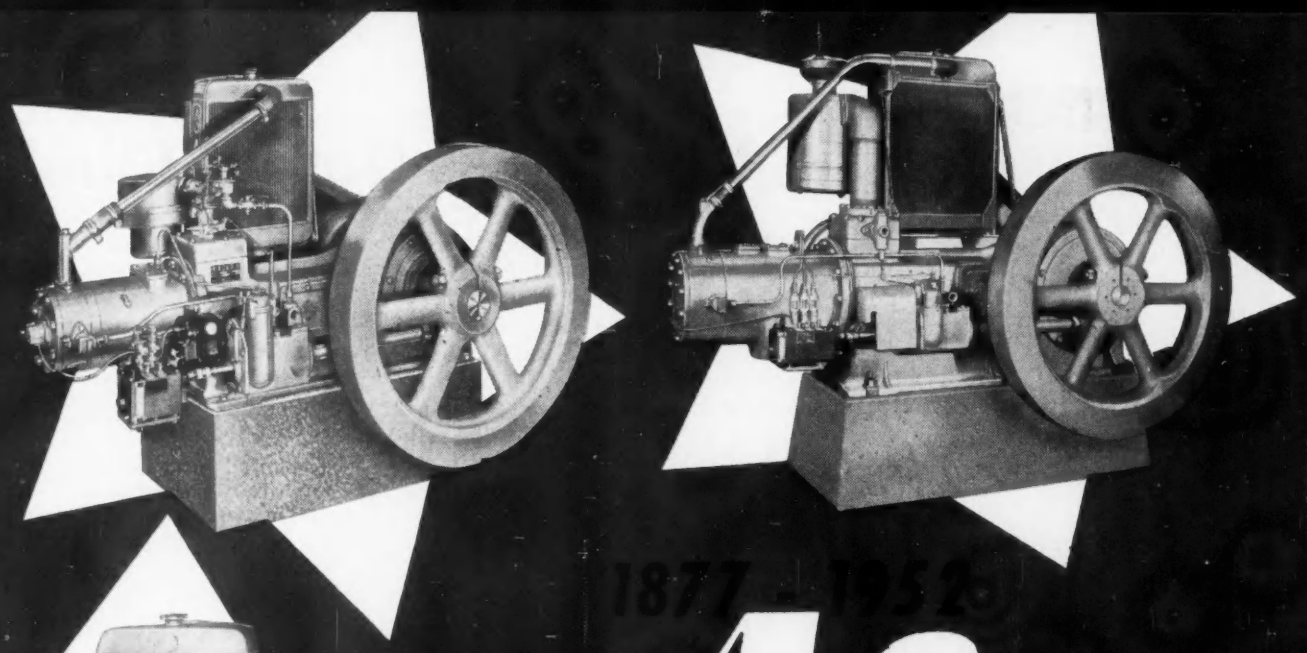
Gulf geologists report the oil potential in Barbados as excellent, though to reach the possible producing formations drilling to depths of from 10,000 to 12,000 feet is expected to be required.

Petroleum has long been known in Barbados but has never been produced in any great quantity. As early as 1870, only a few years after the discovery of oil in the U. S., some quantities of extremely high quality lubricating oil were being produced from hand-drilled wells of less than 100-foot depth. Some of this superior lubricating oil was exported to Russia for use on the Siberian railroad, since it had a very low freezing point.

The topography of Barbados has long piqued the imagination of geologists. A coral rock formation covers the surface of most of the island like a thick pie crust. Beneath that are many anticlines or faults viewed as possible oil collecting traps.

Actual production of oil in the island has existed for more than 50 years, and small quantities of so-called Barbados "tar" were exported in the 19th century. This was a viscous crude oil skimmed from seepages or extracted from shallow wells sunk into outcropping sands. First recorded commercial oil development in Barbados was the Lloyd's oil wells on the island's east coast around 1880. These were also shallow wells and there were 21 of them at the time of maximum development.

Between 1896 and 1903, West Indian Oil Company, which later became the West Indian Petroleum Company, drilled 14 wells ranging in depth from 540 to 1653 feet. The company also put down some 50 hand-bored holes, with depths ranging from 60 to 100 feet. Barbados Union Oil Company began operations in 1919 and is producing natural gas on a limited scale at present from one or two wells, but the company has done no drilling in recent years.



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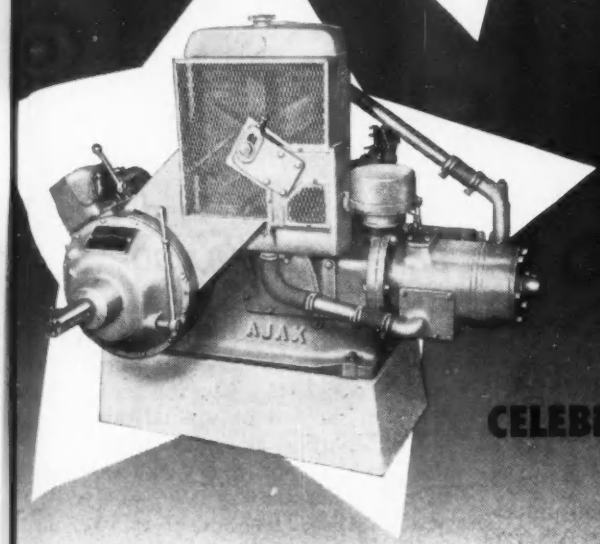

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Calgary Firm Gets Big Lease

Britalta Petroleum, Ltd., of Calgary announced signing of an agreement with the Saskatchewan government for drilling rights on 1,059,520 acres of Saskatchewan crown land.

Britalta acquired the million-acre lease from a Regina resident, with the company retaining all interest in the land except a 2½ percent override in a contract with the landowner and the provincial government.

The Britalta lease extends from Saskatchewan to Prince Albert, Saskatchewan, and is contained in a block approximately 78 miles north and south 48 miles east and west. The agreement between Britalta and the province will run to April 30, 1954.

Magnetometer and gravity meter surveys have been carried out on Britalta's Saskatchewan acreage, and the company is completing plans to start drilling operations.

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Effort Is Made To Raise Italian Refinery Output

Condor Company of Milan recently increased its capital from approximately $4,875,000 to $9,750,000 to finance construction of an oil dock at the port of Genoa, a coastwise station at Genoa-Fegino, a pipe line between the coastwise station and Milan and a refinery at Milan with a capacity of slightly more than 7 million barrels annually.

The stock increase was voted in an effort to speed up the Italian program of enlarging the Italian refining industry.

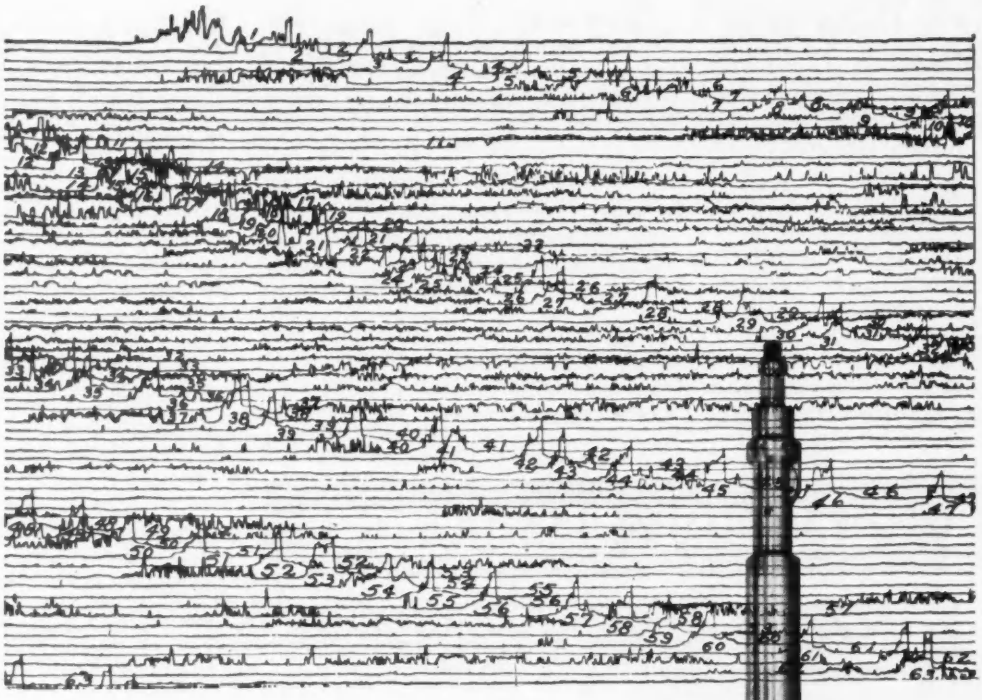
These plants are scheduled to begin operation in December, 1952. Application for additional crude processing capacity also has been filed by Raffinerie Siciliane Olii Minerali of Palermo, which is operating the AUGU Augusta (Syracuse) refinery. The refinery's current capacity is approximately 4,250,000 barrels annually, and RASIOM is seeking to have it raised to more than 7 million barrels.

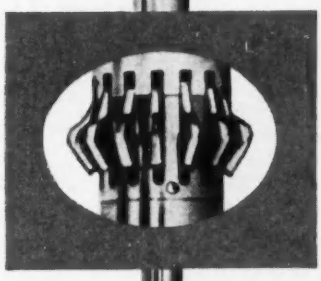
This program is based on increase of fuel oil consumption in Italy. Since the program would involve increased yield of water white products, which cannot be sold in Italy, the refining industry has requested the government to allow free exports of gasoline, kerosine, etc., but the Italian Foreign Trade Ministry insists foreign market sale of such products should be authorized only if foreign countries who want to purchase them allow the free imports into Italy of coal, steel, etc.

The problem of exporting Italian water white products is becoming increasingly acute, since the Italian government has increased the tax on motor vehicles, thus reducing domestic gasoline consumption.

Stalin Orders More Oil

Premier Stalin has ordered an annual crude production rate in Russia totaling nearly 436 million barrels for 1960. At the same time, importance of Russia's eastern regions to the oil industry was emphasized. While only 11 percent of the Soviet total production was obtained from its eastern regions in 1940, this figure was boosted to 48 percent in 1951. Last year's crude output was estimated at about 334 million barrels, approximately 58 million barrels behind the planned quota drawn up in 1940.





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It's pretty easy, therefore, to see why Monel and "K" Monel are used in the Otis Tubing Caliper and other Otis sub-surface tools for oil wells. When this instrument is run, full shut-in well pressure is admitted to every working part — including the gears, gear shafts and ratchets, including even the stylus rod that plots the minute variations of each feeler point.

Otis relies on the ability of Monel and "K" Monel to stand up when the going is tough. And stand up they do — in places where other materials often *fold* up!

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WHEN THE OTIS Tubing Caliper is run, closely spaced spring-loaded feelers (inset) press against inside of tubing wall, and a rotating stylus plots location and depth of each corrosion pit. Numbers on either side of coupling deflections (see chart) refer to the tubing joint in the well. Many working parts of the caliper — including internal chart chamber, stylus rod, gears, shafts and ratchets — are made of Monel or "K" Monel to withstand effects of severely corrosive conditions. For complete information about Otis Tubing Caliper surveys, write *Otis Pressure Control Inc.*, Dallas, Texas, through whose courtesy the illustrations and technical information on this page were supplied.

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Pipe Laying Is Under Way On Trans-Mountain Oil Line

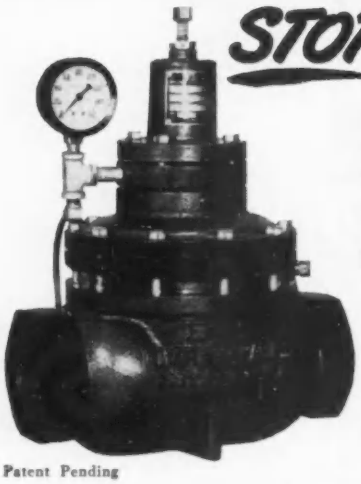
Men and equipment were pouring by rail and highway into the Rocky Mountains of British Columbia and Western Alberta as work on Trans-Mountain Oil Pipe Line Company's projected mountain-straddling oil line swung into high gear last month.

Laying of pipe on the eastern third of the line began June 1. Clearing and grading crews pounded out 43 miles of line grade near the Alberta-British Columbia border-straddling Yellowhead Pass. More than 600 workers were employed.

At the height of pipe-laying operations about 650 men will be employed on what has been described as one of the great engineering projects in Canadian history.

Completion of the pipe line will link Edmonton with Burnaby, eastern suburb of Vancouver, B. C., where refinery construction has been stepped up in anticipation of the arrival of Alberta crude oil. Cost of the Trans-Mountain line has been estimated at about $82 million. Comstock Midwestern Company, Ltd., is the contractor on the eastern and western third of the project.

BACK PRESSURE REGULATORS



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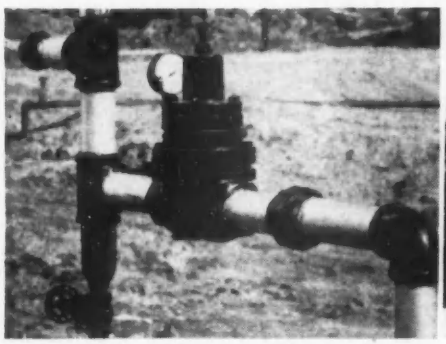
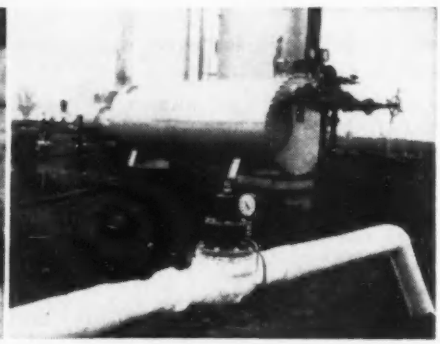


KIMRAY-PARKS BACK PRESSURE REGULATOR on treater vent saves gas to help fire burner.



Ice-covered KIMRAY-PARKS REGULATOR holds constant pressure despite low temperature.

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OKLAHOMA CITY, OKLA.—Kimray, Inc.

Methane Gas Discovery Is Announced By AGIP

Azienda Generale Italiana Petroli, the Italian oil monopoly, has announced discovery of a new hydrocarbons structure at Bordolano in the Milan district. On Nov. 26, the well was reportedly completed with production of 7 million cubic feet of methane daily. Consequently, AGIP decided to begin drilling two more wells in the zone.

According to AGIP, with the Bordolano field discovery, Po Valley output of methane gas will be increased to more than 425 mcf daily upon completion of the projected gasoline system.

German manufacturers of gas and oil industry equipment and machinery have offered assistance to AGIP, and the Italian government announced its willingness to import such equipment from Germany provided payment can be made with agricultural products.

Athabasca River Area Due For Exploratory Program

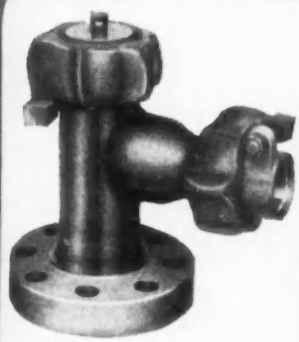
First large-scale exploratory work toward producing heavy crude from the sands in the Athabasca River area of northeastern Alberta province, about 165 miles northeast of Edmonton, is scheduled to start this summer. Five Canadian companies have paid deposits of $1 an acre on 250,000 acres in the Mildred Ruth Lake area for this exploratory development, according to N. E. Tanner, Alberta Minister of Mines.

Athabasca oil, described as thick as molasses, is mixed with sand in a bed 100 to 200 feet thick and contained in an area estimated to comprise from 8000 to 30,000 square miles. Estimated deposits in the sand range from 100 billion to 300 billion barrels of recoverable oil. Interest in the area heretofore has not been great due to lack of an economical method of separating the liquid from the sand and a means of transporting the crude to markets.

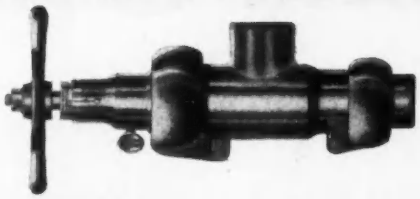
Gas Test Is Scheduled

A production test will be carried out at the gas well Frenswegen 1 near Nordhorn, Germany, which is owned jointly by C. Deilmann, Gewerkschaft Elwerath, Preussag and Wintershall AG. Composition of the gas and optimum production quota will be ascertained to decide whether the gas can be used for repressuring in the Georgsdorf oil field, as originally planned. The gas is now being supplied to a textile mill at Nordhorn.

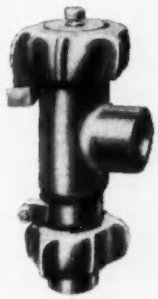
The Right Combination



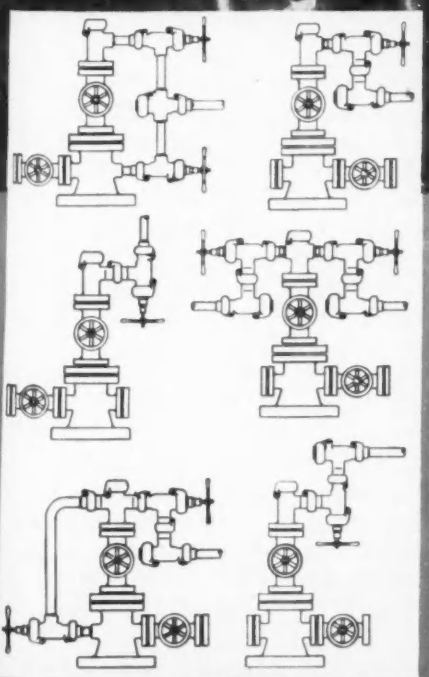
The UNIBOLT Tee (or Cross) with blanking plug on top is available in flanged, flanged by screwed, flanged by Unibolt, etc., and in any combination of sizes.



The UNIBOLT Wing Valve takes the place of a gate or plug valve on the wing of the tree to provide a dependable shut-off for choke changing. Since high pressure wells are usually produced through a small choke, resulting in low velocity flow through the tree, the one-inch opening in this valve is ample to assure unrestricted flow.



The UNIBOLT Choke Body, fitted with positive bean ("X" Type increments of 5% and 10% of flow, or regular beans of 1/64" increments) provides proven, dependable, safe and convenient flow control.



...to make any tree lighter, stronger and more economical

Employing standard UNIBOLT connections rather than flanges, the UNIBOLT Flow Manifold is many pounds lighter, yet the UNIBOLT design, which places more steel in shear, actually results in a higher factor of safety for the manifold.

The units of the manifold — UNIBOLT Tee or Cross, Wing Valve, and Positive Choke Body — are pressure-tested as a unit and may be assembled in a number of combinations to best meet individual needs. They are furnished in regular forged steel or in high-chrome alloy for corrosive wells — 6,000, 10,000 and 15,000 lbs. test. The manifold is completely salvageable.

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UNIBOLT *Flow Manifolds*

Of World Oil Men

DR. S. K. CHAKRAVORTY, former principal geologist with the Saskatchewan Department of Natural Resources, has been appointed as chief oil and gas conservation officer for the province. In his new position, Chakravorty will administer Saskatchewan's new oil and gas conservation act and supervise the sedimentary geology division of the minerals branch.

M. M. TOMILIN, formerly a senior geologist in the Department of Natural Resources, has been appointed principal geologist in charge of sedimentary geology.

DR. A. J. BUDDING, formerly a department geologist, has been appointed principal geologist in charge of pre-Cambrian geology.

ANDREW NEILSON has been elected a vice president and director of California-Texas Oil Company, Ltd. In his new capacity, Neilson will also continue as president of Overseas Tankship Corporation, a Caltex affiliate, a position he has held since December, 1947.

Andrew Neilson

Directly connected with shipping activities for the past 28 years, Neilson went to sea directly after graduating from high school. He received his second mate's license in 1928 and sailed with the Standard Oil Company of California fleet for five years. He left the sea in 1934 to attend college, and was graduated from Stanford University in 1938 with a degree in economics. Neilson rejoined California Standard after college and in 1943 participated in the formation of Pacific Tankers, a wartime tanker organization formed at the request of the War Shipping Administration.

He served as general manager of that organization from 1944 to 1946 and in the latter year joined Overseas Tankship as vice president.

Dale Nix

J. C. Stirton

DALE NIX and J. C. STIRTON have been elected vice presidents and E. G. VOSS treasurer of Arabian American Oil Company. Nix will be in charge of technical and supply services. He has been in the oil business 25 years and has been with Aramco since 1940, when he became manager of the producing, pipe line and transport department. Last year, he was named general manager of oil operations. Stirton is in charge of engineering and construction. He has been associated with the oil industry for 33 years, starting with Standard Oil Company (Indiana) in 1919. He became chief engineer for Arabian American in 1944. Voss started his oil career as an office boy with Standard Oil Company (New Jersey) in 1934. By 1946 he was elevated to head Jersey's investment and finance division. Two years later, he became assistant treasurer for Aramco.

E. G. Voss

MALCOLM J. MILLER of San Francisco, Calif., Standard Oil Company of California engineer, returned recently from a four-month corrosion survey in the Middle East for Trans-Arabian Pipe Line Company.

DON ANDERSON of Bartlesville, Okla., superintendent of production in the natural gas division of Cities Service Oil Company (Del.), has been transferred to the company's Calgary, Canada, staff, where he will have charge of drilling and production operations in the Canadian plains area.

A native of Iowa, Anderson joined Cities Service's engineering department after attending Purdue University and graduating from the University of Iowa in 1930 with a degree in mechanical engineering. His experience in gas pipe line, gas production and exploratory work led to his position with the natural gas division in 1945, where he remained until his present promotion.

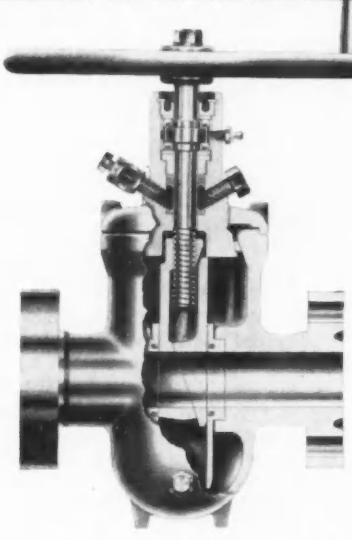
ALBERT D. DUNLAP, seismograph exploration party chief for Independent Exploration Company, has been named to supervise all of the company's Canadian operations, with headquarters at Calgary, Alberta. Dunlap was graduated from Rice Institute at Houston, Texas, and joined Independent Exploration Company in 1933.

EDWARD McNEIL, who has assumed his new position as vice president of Standard Oil Company of Brazil in Rio de Janeiro, has completed 34 years of service with Standard Oil Company (N. J.) and its affiliates. Previously, he was assistant treasurer of the parent company in the New York headquarters.

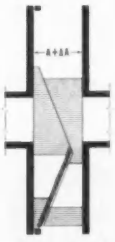
Edward McNeil

After joining the company in 1917, McNeil served in various positions at Esso's Bayway, N. J., refinery prior to transferring to the Treasury department in 1927 as assistant foreign exchange division head. He was placed in charge of the division in 1942. Two years later, he was appointed assistant treasurer. In addition to his treasury work, McNeil has served as a director of several Jersey affiliates.

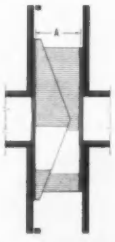
J. C. MARTIN, JR., has resigned as division manager in Canada for The Bay Petroleum Corporation to accept an appointment as vice president and manager of Rio Tinto Alberta Oils Limited and Punch Petroleums Limited, with offices in Calgary.



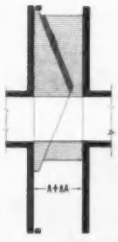
All W-K-M Valves have a perfectly smooth bore. There are no cavities or projections to cause turbulence or to collect sediment. Gates and seats are protected against cutting or damage of any kind. These advantages are a result of the W-K-M Expanding Gate development which is explained below.



In closed position, the gate (left) and segment (right) seal tightly against both seats.



When opening or closing, the gate and segment are in neutral position permitting free upward or downward movement of the gate assembly.



When open, the gate and segment again seal tightly against both seats and the bore of each lines up perfectly with the bore of the body to provide a smooth, full-round conduit.

You can ***completely*** overhaul a W-K-M Valve right on the tree in one hour! When overhauled, the valve becomes as good as new, ready for many more years of efficient, trouble-free service.

There is no need to go into great detail to point out the advantages and economies of on-the-spot repair or overhaul. Frequently the time and money saved will amount to much more than the cost of the valve.

Long run performance is far more important than first cost. When you buy, specify W-K-M and you'll be sure of satisfactory operation for the life of your tree.

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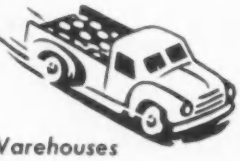

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Quality Oil Field Lubricating Oils and Greases

Men in the Industry NEWS

Four top appointments in the production division of Cities Service Oil Company have been announced. **J. A. Cleverley** of Bartlesville is manager of the division, succeeding **M. J. Kirwan.** Kirwan has retired but will continue to act in a consulting capacity.

C. E. Beecher of Bartlesville, former general superintendent of the division, is now director of production research and development.

C. R. Smith, formerly assistant division superintendent at Odessa, Texas, is in Bartlesville as general superintendent of the division.

Kirwan's retirement comes after almost 45 years in the field of oil and gas production in the United States and the Orient, starting back in 1908 when he was field engineer for Associated Oil Company.

Cleverley, the new production division manager, is a long-time Cities Service employe, entering company service in 1920 as a junior engineer. He has served in various executive capacities in the company's oil production division at Oil Hill, Madison and Russell, Kansas, and Oklahoma City.

Beecher was employed by Cities Service in 1924 to do special research on the physical characteristics of crude oil as it exists underground. His pioneering work in the field of reservoir engineering stimulated interest in the theory of field unitization and operation. Since 1927, Beecher has served in various executive capacities in the production division.

Smith, is a 25-year man with Cities Service. He began his Cities Service career as a junior engineer and served as production engineer and in other capacities at Seminole, Oklahoma City, Bartlesville and Odessa.

•

Reynolds Girdler has been named director of public relations and advertising for Sinclair Oil Corporation and subsidiary companies. Formerly a vice president and account executive for Carl Byoir & Associates, Girdler began his career with Doremus & Company and was later an editor of *Time* and a financial columnist for *Nation's Business.*

W. K. Warren was named chairman of the board and chief executive officer of Warren Petroleum Company in Tulsa. **J. A. LaFortune** was named vice chairman of the board and **James E. Allison,** president.

J. E. Allison

D. L. Connelly

Warren has been president of the company since its founding 30 years ago. LaFortune joined the company in 1924 as secretary, became vice president in 1929, and executive vice president in 1943. Allison has been a vice president, general counsel and director since 1946.

Allison, a native of San Saba, Texas, is a 1921 law graduate of the University of Texas. He later practiced law at Breckenridge, Texas. He represented The Hanlon Companies in the early 1920's and resigned from his law partnership in 1937 to become general counsel for those corporations with headquarters in Tulsa.

When The Hanlon Companies were acquired by Warren Petroleum Corporation in 1946, Allison became a vice president, general counsel and director of Warren.

The Warren Board of Directors also has announced the election of **D. L. Connelly** of Houston as a vice president and director of the corporation. Connelly has been president and director of Warren Oil Corporation, a wholly owned subsidiary, since Jan. 1, 1948.

He is a native of Pennsylvania and entered the oil business in 1922 as a scout and land man for the former Gypsy Oil Company.

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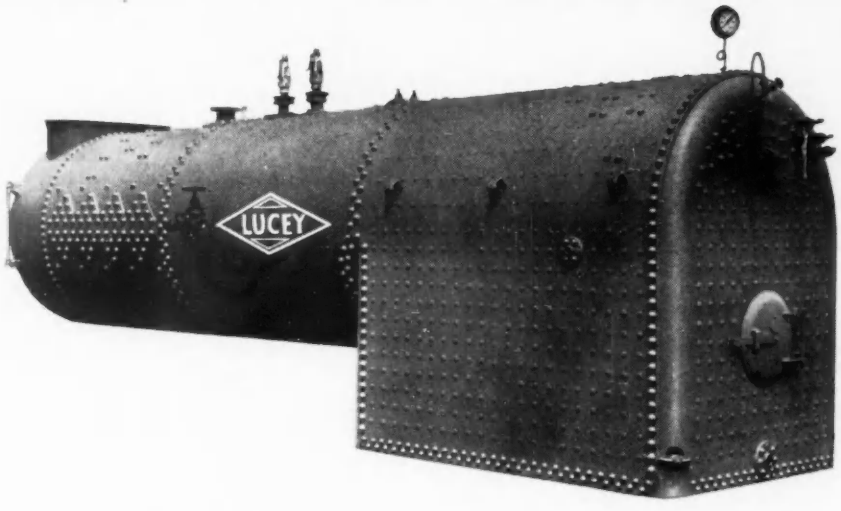

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Earl W. Russell has been elected an additional assistant secretary of Standard Oil Company (Indiana). He has been administrative assistant in the office of **President A. W. Peake.**

E. W. Russell

Russell joined Standard in 1928 as a clerk in the Indianapolis, Ind., sales field. In 1938 he was transferred as an analyst to the sales research department in the general office at Chicago and in 1942 became office manager of that department. He was promoted to administrative assistant in the president's office in 1946. Russell was a Navy officer for two years during World War II.

•

W. P. Carver has been named assistant to the manager of General Petroleum Corporation's Land department.

Carver has been with General Petroleum since 1938. His most recent assignment was in Bakersfield, Calif., where he was in charge of land matters for the San Joaquin Valley area.

•

David Graham and **John E. Swearingen** have been elected directors of Standard Oil Company (Indiana). Graham is financial vice president of Standard and Swearingen is general manager of production for the company. Swearingen at 33 is the youngest executive ever elected to the board.

Graham joined Standard as financial vice president Jan. 1, 1952, coming from a similar position with the Weyerhaeuser Timber Company at Tacoma, Wash. A native of Ireland, Graham is a graduate of Queens University, Belfast. He came to the U. S. in 1927 as a Commonwealth Fellow at Massachusetts Institute of Technology.

Swearingen joined Standard Oil Company (Indiana) in 1939 as a chemical engineer in the Whiting, Ind., research laboratories. He went to Chicago in 1951, as Standard's general manager of production.

Swearingen is a native of Columbia, S. C., and a graduate of the University of South Carolina in chemical engineering. He has a master of science degree from Carnegie Institute of Technology.

•

J. Howard Marshall has been named a director of Signal Hill Oil and Gas Company. He is located at the company's division office in Fort Worth, Texas, and in charge of exploration in the Mid-Continent area, under the direction of **D. H. Lycan**, a director and vice president of the organiaztion.

Marshall is a former president of The Ashland Oil and Refining Company. He has taken an active part in the American Petroleum Institute and National Petroleum Council.

•

Willard M. Payne has joined Harris & Payne, Consulting Geologists of Jackson, Miss. Payne will direct additional activities of the firm from offices in Naples, Fla. Home offices of the organization remain in Jackson. Payne was associated for many years with The California Company.

G. P. Crombie has been promoted to chief geologist, and **R. P. Galbraith** has been appointed chief land man of the Texaco Exploration Company.

Crombie was born in Edmonton, and before joining the staff of the Texaco Exploration Company in 1948, he was with the Department of Mines and Resources (Geological Survey), Ottawa. He received a B.S. degree in geology and chemistry from the University of Manitoba, and his M.A. and Ph.D. degrees from the University of Toronto.

Galbraith was born in Guelph, Ontario. He received his B.A. degree and his law degree from the University of Alberta, and has also done post-graduate study in law at the University of Toronto. Before joining the Texaco Exploration Company in 1949 he was with Porter, Allen and Millard, barristers and solicitors, at Calgary.

•

George S. Patterson is the new president of The Buckeye Pipe Line Company. A native of Pennsylvania and a 1931 graduate of Yale University, Patterson joined Buckeye in 1940 after previously being connected with The Pennsylvania Railroad.

He was made vice president of Buckeye in 1948. During World War II he served in the Marine Corps.

Patterson succeeds **John H. Pepper**, president of Buckeye since 1948, who now becomes chairman of the board. **Walter E. Jennings**, a vice president since 1950, becomes executive vice president. Jennings began with Buckeye in 1908 as a telegraph operator. He has been oil traffic manager of Buckeye since 1944.

•

Robert P. Davidson has been named oil attorney for Northern Pacific Railway Company in Billings, Mont. Davidson, a member of the Wyoming bar, has been with General Petroleum Corporation for the past 14 years.

Harold S. Skinner has been promoted to the newly created position of assistant regional general manager for Continental Oil Company's central region. Headquarters are in Oklahoma City.

Skinner joined Continental in 1948 as an attorney in the general offices at Ponca City, Okla. He previously was in private law practice. A native of Wetumka, Okla. he was graduated from the University of Missouri in 1929 and from the University of Oklahoma law school in 1932.

•

Walter G. Beach, supervisor of publications for Humble Oil & Refining Company, has been elected president of the International Congress of Industrial Editors.

Walter Beach

Beach is a member of the Houston chapter of the Society of Associated Industrial Editors. He has served as president of S.A.I.E. and twice as Southwestern area vice president for I.C.I.E.

He received his degree in journalism from St. Edward's University in Austin and did graduate work at the University of Texas. During his years in college, he wrote sports publicity and taught journalism classes. Beach joined Humble in 1935 and has been supervisor of publications for the past six years.

H. G. Horstman has been appointed assistant to the president of Texas Gas Transmission Corporation. Horstman has been with the company since May 1950 as Director of Sales and Customer Relations.

H. G. Horstman

Prior to joining Texas Gas he was, for five years, personnel director of Public Service Company of Indiana. He also served in that company's operations department as assistant to the vice president, and between 1933 and 1944, as gas and water distribution engineer.

A graduate of Purdue University, with a degree in chemical engineering, Horstman entered the utility field as a cadet engineer with Northern Indiana Gas & Electric Company.

•

R S. McFarland was recently elected executive vice president of Seaboard Oil Company of Delaware in charge of operations in the U. S. and Canada. He will have headquarters in Dallas.

J. P. Gasser, vice president, will be executive assistant. R. A. Stehr was elected vice president to be co-ordinator of exploration. **Malbert Schwartz** was named vice president and will replace McFarland as manager of Midcontinent Division.

N. A. Rousselot was also named vice president and will continue as manager of the Western Division at Los Angeles. **B. H. Faulkner** continues as vice president in charge of finance with headquarters in New York City.

A. W. Vitt was named manager of operations in the Rocky Mountain area with headquarters at Casper, Wyo. **W. W. Powell**, with headquarters at Calgary, Alberta, continues as manager of Canadian operations.

Other personnel changes include the appointment of **H. C. McCarver** as chief geophysicist, **R. G. Williams** as purchasing agent and **C. J. Maki** as manager of gas operations.

•

O. O. McKenzie, Topeka, Service Pipe Line Company's Nebraska division manager, has been transferred to Shawnee as Oklahoma division manager. **J. E. Polston**, Oklahoma division manager for many years, died recently.

Harry C. Jones, acting Oklahoma division manager, was transferred to Topeka and promoted to Nebraska division manager.

A native of LaPlata, Mo., McKenzie joined Service Pipe Line in 1926. He worked in Oklahoma, Nebraska and Illinois before being named Nebraska division manager in 1950, and advanced from an operator gauger at LaPlata, his first job with the company, to chief station engineer to district superintendent.

Gus L. Maciula, Tulsa, a senior engineer, was transferred to Shawnee and promoted to assistant division manager in charge of southern Oklahoma districts. He is being replaced in Tulsa by **H. T. Chilton, Jr.**, Lubbock, Texas, an area engineer for the company's West Texas division.

I. W. Rogers, drilling superintendent for Makin Drilling Company, Hobbs, New Mexico, and O. D. McCallum, K & G district manager in Hobbs, inspect broken bit removed from hole.

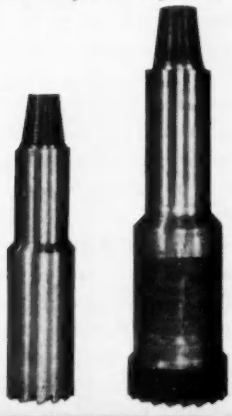
POWERFUL K & G MAGNETIC FISHING TOOL REMOVES 12" ROCK BIT AT 3000 FEET

When you lose a 12" rock bit at 3020 feet, you've got a fishing problem. Makin Drilling Company, Hobbs, New Mexico, called K & G to clean the hole.

The 12" rock bit, dropped approximately 190 feet, lost all four cones and shanks. A powerful 11½" ultra-magnetic K & G Fishing Tool successfully recovered all the bit—as shown in the picture above—all four cones, shanks, bearings and broken pieces of metal.

The result of seven years' field experience and research, the K & G Magnetic Fishing Tool has been proved by hundreds of such runs to be the most practical fishing tool yet developed for removing small junk—chipped teeth, lost cones, bearings, sledge hammers—even bits.

Ruggedly designed to withstand all normal operations, the K & G is made in various sizes and styles of rotary shoes to assure maximum junk recovery in any hole at any depth. The powerful magnet, controlled and localized at the pole plate, is equally effective in cased wells. Run on tubing, drill pipe or wire line.



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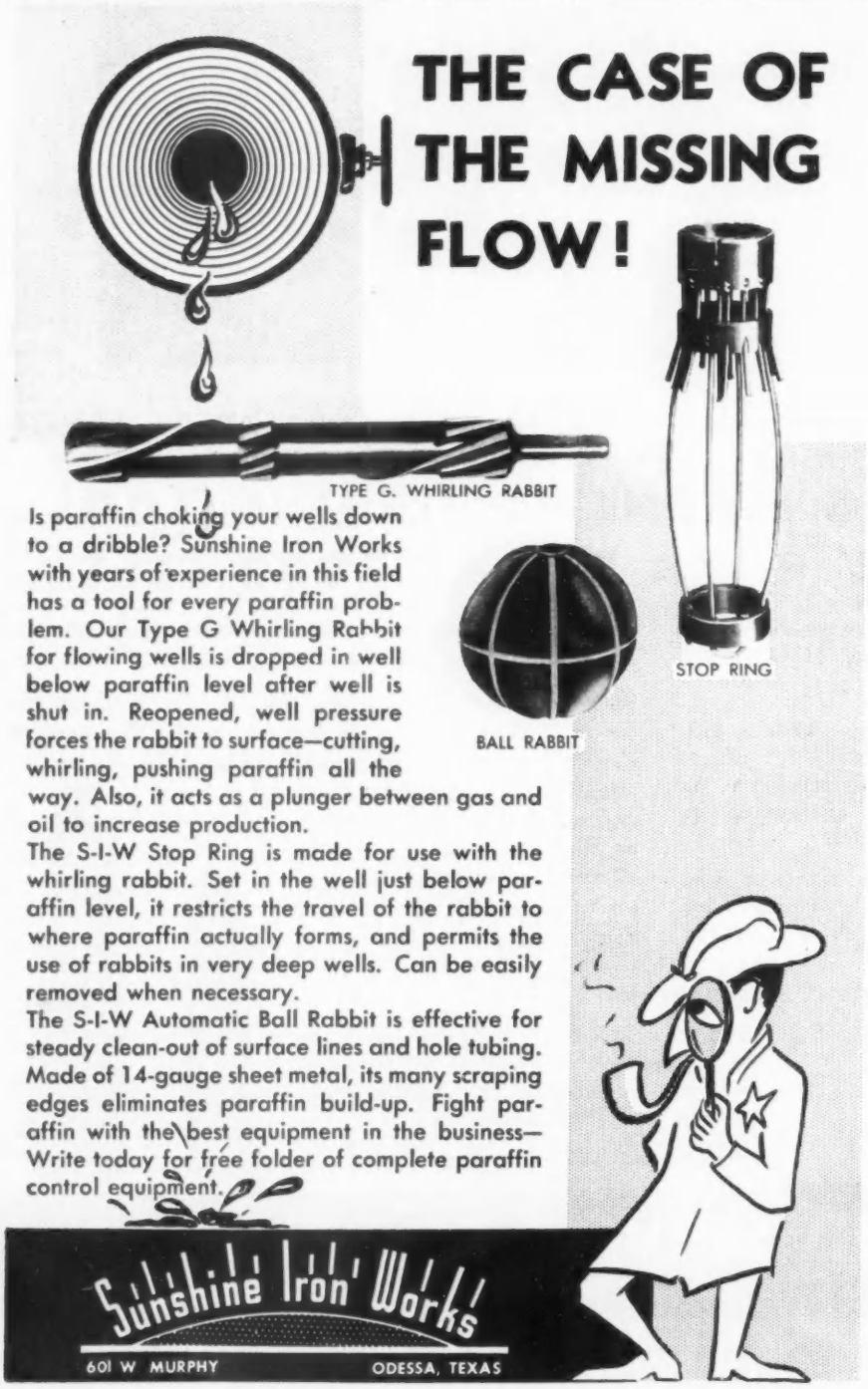
Sunray Oil Corporation in Tulsa has announced several executive changes. Former President **C. H. Wright** becomes chairman and chief executive officer. **F. B. Parriott** has resigned this position and is now chairman of the executive board.

W. C. Whaley has been elected president of the corporation to succeed Wright. Whaley was transferred to Tulsa from Los Angeles where he was formerly vice president and manager for the company's California division.

F. L. Martin has resigned as a director and vice president in charge of the refining and pipe line division to become president Suntide Refining Company. Suntide is a new company organized by Sunray and outside banking interests to construct and operate a new catalytic refinery in the Corpus Christi, Texas, area.

Other officers elected by Sunray's board of directors are: **Edward Howell,** vice president and general counsel; **Paul E. Taliaferro,** vice president and assistant to the president; **H. O. Harder, H. W. Manley, R. E. Foss, M. Darwin Kirk** and **W. L. Horner,** vice presidents; W. D. Forster, secretary, and **L. W. Bennett,** treasurer. Bennett was elected a director of the corporation to fill the vacancy on the 13-member board caused by the resignation and retirement of Martin. Horner, who has been manager of the company's reservoir engineering department, is vice-president in charge of this activity.


THE CASE OF THE MISSING FLOW!
TYPE G. WHIRLING RABBIT
STOP RING
BALL RABBIT
Is paraffin choking your wells down to a dribble? Sunshine Iron Works with years of experience in this field has a tool for every paraffin problem. Our Type G Whirling Rabbit for flowing wells is dropped in well below paraffin level after well is shut in. Reopened, well pressure forces the rabbit to surface—cutting, whirling, pushing paraffin all the way. Also, it acts as a plunger between gas and oil to increase production.
The S-I-W Stop Ring is made for use with the whirling rabbit. Set in the well just below paraffin level, it restricts the travel of the rabbit to where paraffin actually forms, and permits the use of rabbits in very deep wells. Can be easily removed when necessary.
The S-I-W Automatic Ball Rabbit is effective for steady clean-out of surface lines and hole tubing. Made of 14-gauge sheet metal, its many scraping edges eliminates paraffin build-up. Fight paraffin with the best equipment in the business—Write today for free folder of complete paraffin control equipment.
Sunshine Iron Works
601 W MURPHY
ODESSA, TEXAS

E. J. Hamner

J. S. Bell

E. J. Hamner has been named manager, and **John S. Bell** assistant manager of California operations for Humble Oil & Refining Company.

Hunter Yarbrough is area geologist in direct charge of exploration and **Lawrence H. Byrd** is area production superintendent in charge of drilling and producing.

Hamner was graduated from the University of Oklahoma in 1932 with a B.S. in geology and an M.S. in petroleum engineering. He had been a summer-time employe of Humble during his school years and joined the company upon his graduation. He moved from the Production department into the Exploration department in 1934 and worked in the Southwest Texas and Gulf Coast areas until he was promoted to assistant chief geologist in Houston in 1946. In December, 1948, he went to California as manager of Exploration.

Bell received a B.S. degree in petroleum engineering from the University of Oklahoma in 1930. He joined Humble in 1933 as a rotary helper and was made district petroleum engineer for Southwest Texas in 1934. He was later division petroleum engineer in North Texas and East Texas. He went to California in 1951 as district superintendent.

A graduate of the University of Texas with a B.S. in geology, Yarbrough joined Humble in 1940 as a junior evaluation geologist and from 1941 to 1945 was in military service. He re-entered Humble's Exploration department after the war and in 1947 was made staff geologist. He went to California in 1948.

Byrd is a graduate in chemical engineering from Texas A. & M. He joined Humble as a roustabout in 1937 and worked in East and Southwest Texas and the Gulf Coast. After service in the armed forces, he rejoined the Production department. In 1948 he was made assistant district superintendent at London, Texas, and in June, 1951, went to Los Angeles as assistant district superintendent.

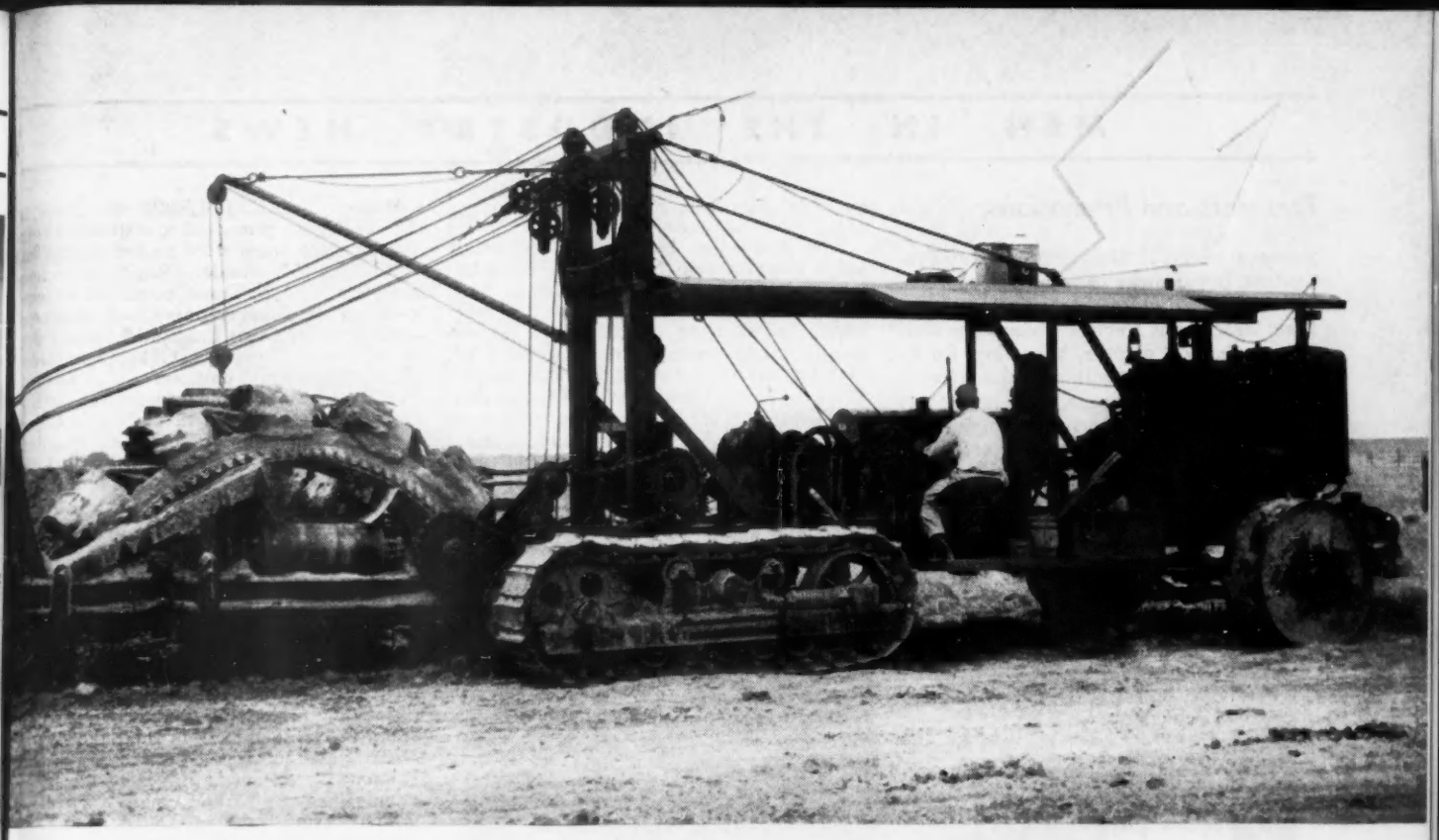
●

E. R. Filley, general manager of the Producing Department, The Texas Company, has been awarded the Doctor of Laws degree by Baker University, Baldwin, Kansas.

The degree was conferred at the 94th commencement held recently on the campus. Filley, who has been with The Texas Company since graduation from Baker in 1915, has been a member of the university board of trustees for several years and is a former vice president of the trustees.

●

Joe A. Laird has resigned as associate professor of petroleum engineering at Texas A. & M. College to become a candidate for the Railroad Commission in Texas.



On ~~Down~~-time

Aggravating, money-grabbing down-time has been eliminated on this 42-mile pipe-laying job by a tireless "Caterpillar" Diesel D13000 Engine. Houston Contracting Co., Houston, Tex., declares flatly "the job is on schedule due to dependable 'Caterpillar' power."

For four bustling years, the hard-working D13000 Diesel has pumped unfailing power into this Buckeye Ditcher *without a shutdown for repairs.* On a job, its unflagging output is required the clock around or the entire operation squeals to a costly halt.

"This is the only ditcher on the job," reports a company foreman. "It runs 24 hours a day. Progress of the entire job depends on this ditcher."

The big mucker is digging 6,000 feet a day of a 6-foot trench 44 inches wide. The 30-inch loop line between Cypress and Fostoria, Tex., is being laid for the Tennessee Gas Transmission Co.

"Caterpillar" Diesel Engines have their inexhaustible energy built into them at the factory. Their fuel systems are designed so you can forget about operating adjustments. Their injection valves are interchangeable. They burn low-cost, non-premium fuels without fouling.

Specify "Cat" Diesels in the equipment you buy. And, visit your "Caterpillar" Dealer. He has a wide selection of dependable power units to keep your job on schedule.

CATERPILLAR TRACTOR CO. • PEORIA, ILLINOIS

CATERPILLAR

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DIESEL ENGINES
TRACTORS • MOTOR GRADERS
EARTHMOVING EQUIPMENT

Transfers and Promotions:

Recent transfers in Shell Oil Company Production Department include: **Theodore S. Mitchel,** from division mechanical engineer, Long Beach, Los Angeles division, to division mechanical enginer, Wyoming, Rocky Mountain division, with headquarters in Casper; **William E. Spear,** from senior mechanical engineer, Bakersfield, San Joaquin division, to senior mechanical enginer, Montana, Rocky Mountain division, with headquarters in Glendive and **David F. Toomey,** from mechanical engineer, Long Beach, Los Angeles Basin division, to mechanical engineer, Montana, Rocky Mountain division, with headquarters in Glendive.

The Production Department of Sinclair Oil & Gas Company has announced the following transfers and reclassifications: **Charles W. Shawn,** roustabout, at Ardmore, Okla., to assistant district foreman and transferred to Sedan, Kans. . . **Robert W. Stallings,** assistant district foreman, located at Odessa, Tex., transferred to Velma, Okla. . . . **Robert W. Hard,** assistant district foreman, at Russell, Kan., transferred to Odessa, Tex. . . . **Levi H. Straily,** assistant district foreman, at Sedan, Kans., transferred to Plainville, Kans. . . . **Ollie W. White, Jr.,** junior petroleum engineer, at Delaware, Okla., promoted to intermediate petroleum engineer. . . . **E. J. Lisius,** roustabout, at Kiefer, Okla., promoted to assistant district foreman and transferred to Ardmore, Okla.

Charles M. Rieder, junior petroleum engineer, at Arp, Texas, promoted to intermediate petroleum engineer, and transferred to Columbus, Texas. . . . **Daniel Tabachnick,** roustabout, at Delaware, Okla., promoted to junior petroleum engineer . . . **Clayton Walker,** junior petroleum engineer, at Kiefer, Okla., transferred to Tulsa . . . **Robert A. Kidd,** intermediate petroleum engineer, at Drumright, Okla., transferred to Oklahoma City . . . . **Charles B. Ammann,** roustabout at Kiefer, Okla., promoted to junior petroleum engineer, transferred to Drumright, Okla. . . . **Oliver W. Welch,** senior clerk, at Covington, Okla., transferred to Independence, Kans. . . **Cleon Faught,** intermediate clerk, at Drumright, Okla., promoted to senior clerk, and transferred to Covington, Okla.

Henry C. Mugler has been transferred from Magnolia Petroleum Company's land offices at San Antonio to Lake Charles, La. He is district land man for the Lake Charles District and succeeded the late L. U. Kincannon . . . **G. Curtis Mayes,** formerly mechanical engineer at Magnolia's Field Research laboratories in Dallas, has been transferred to the Petroleum Engineering department as a senior petroleum engineer in Dallas. . . **G. W. Walker,** petroleum engineer at Falfurrias, has been transferred to the Lake Charles Producing district as a petroleum engineer . . . **James W. Tucker, Jr.,** formerly petroleum engineer in the Lake Charles district, has been moved to the Falfurrias district as a petroleum engineer . . . **M. H. Beaver,** petroleum engineer in the Luling Producing district, has been transferred to the Falfurrias district . . . **William J. Mannas** has been moved from West Texas Drilling Tools to Kermit, Texas, as a petroleum engineer . . . **J. Frank Wright** has been transferred from the West Texas Drilling Tools to Morgan City, La., as a petroleum engineer.

•

D. G. Kingman, San Joaquin division superintendent of General Petroleum Corporation's Production Department, has been advanced to assistant manager of joint venture operations. Kingman will be located at the Los Angeles headquarters of the company.

Kingman has spent 14 of his nearly 20 years with General Petroleum in the San Joaquin region. He was successively a production foreman, a production engineer, assistant to division superintendent, and production superintendent before becoming division superintendent in 1944.

A native of Riverside, Calif., and a graduate of the California Institute of Technology, Kingman has been active in the American Institute of Mining Engineers and the American Petroleum Institute. He is a district oil and gas commissioner for the Kern, Tulare and Inyo counties area.

John J. Oliphant has been advanced to superintendent replacing Kingman.

Since 1948 Oliphant has been production superintendent of the San Joaquin division. **J. F. Bohns** has been named to succeed Oliphant as production superintendent.

•

Louis H. Weltman has resigned as district geologist for Lion Oil Company in Corpus Christi to open an office as an independent petroleum geologist.

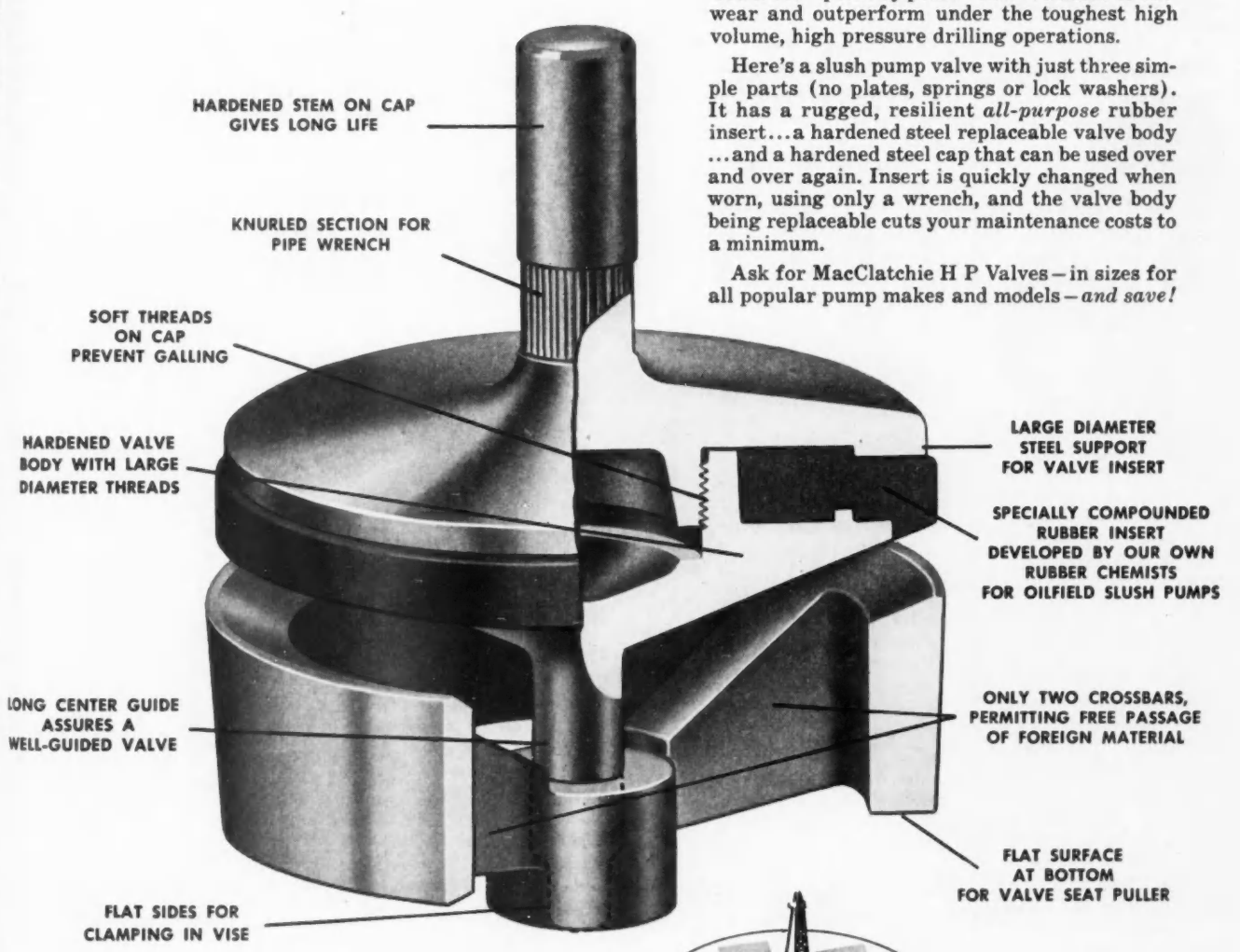
D.Sc.
Dr. Scottie McBlock to the rescue! To save your line . . . your time . . . your money.
Well Logger's
FLOOR BLOCK
For use in high speed well logging . . . . . .
★ Large (3 3/4" I. D.) double row pre-adjusted Timken bearings with rated capacity of 10 tons at 500 R. P. M's.
★ Johns-Mansville "Klipper" grease seals, self adjusting, seal in lubricant at high speeds.
★ Alloy steel flame hardened sheaves, machine grooved to proper size armored logging cable.
★ Quick opening pin for fast stringing up, jointed swivel clevis, alemite lubrication.
Catalog on Request
McKISSICK
McKISSICK PRODUCTS CORPORATION
Box 2496 Tulsa, Oklahoma

Here's the picture of improved pump valve performance!

LOOK OVER the design and construction features of this MacClatchie Type H P Pump Valve. You'll see – point by point – how it's made to outwear and outperform under the toughest high volume, high pressure drilling operations.

Here's a slush pump valve with just three simple parts (no plates, springs or lock washers). It has a rugged, resilient *all-purpose* rubber insert...a hardened steel replaceable valve body ...and a hardened steel cap that can be used over and over again. Insert is quickly changed when worn, using only a wrench, and the valve body being replaceable cuts your maintenance costs to a minimum.

Ask for MacClatchie H P Valves – in sizes for all popular pump makes and models – *and save!*


HARDENED STEM ON CAP GIVES LONG LIFE
KNURLED SECTION FOR PIPE WRENCH
SOFT THREADS ON CAP PREVENT GALLING
HARDENED VALVE BODY WITH LARGE DIAMETER THREADS
LONG CENTER GUIDE ASSURES A WELL-GUIDED VALVE
FLAT SIDES FOR CLAMPING IN VISE
LARGE DIAMETER STEEL SUPPORT FOR VALVE INSERT
SPECIALLY COMPOUNDED RUBBER INSERT DEVELOPED BY OUR OWN RUBBER CHEMISTS FOR OILFIELD SLUSH PUMPS
ONLY TWO CROSSBARS, PERMITTING FREE PASSAGE OF FOREIGN MATERIAL
FLAT SURFACE AT BOTTOM FOR VALVE SEAT PULLER

MacCLATCHIE MANUFACTURING COMPANY

A subsidiary of Grant Oil Tool Co.

MAIN OFFICE & PLANT: COMPTON, CALIFORNIA

Benedict Saurino, manager of Sun Oil Company's Statistical Research division, died in a Philadelphia hospital. He was a native of New York City and a graduate of New York University. He began his business career with Metropolitan Life Insurance Company in 1927. He joined Sun Oil Company in 1936 as a statistical economist in the Philadelphia offices. He was made manager of the company's Statistical Research division in 1944.

•

Neal (Red) Ammons, 53, owner of Ammons Drilling Company and pioneer oil man of Texas, Oklahoma, Illinois and California, died June 2 at his home in Bakersfield, Calif., after a long illness.

DEATHS

L. E. Etchison, head of the Amerada Petroleum Corporation Land department, died of a heart attack May 16 at his home in Tulsa. A native of Texas, he entered the oil business as a land department employe of The Texas Company at Shreveport. He had been with Amerada since 1926.

•

Jim Renshaw, 62, of Hobart, Okla., died June 6 after an extended illness. He was president of Renshaw Oil Company.

RED DEVIL

"DIA-HARD" LINERS

For high pressure abrasive service

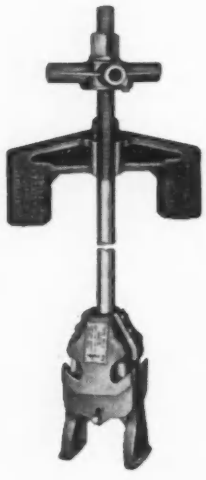
Forged in one piece from highest quality alloy steel. The deep HIGH-CARBON wear resistant case of maximum hardness and uniformity is obtainable only by our SPECIAL "DIA-HARD" PROCESS, greatly excelling all other known methods for longer life liners. The bore is PRECISION HONED, and ACCURATE OUTSIDE DIMENSIONS insure a perfect working fit with liner packing assembly and pump cylinder for positive leakproof sealing. Write for Catalog No. P-120.

TELL-TALE LINER PACKING ASSEMBLIES

Gives warning before damage

Tell-Tale Liner Packing Assembly consists of two "DIA-TEX" oil and heat resistant sealing rings separated by a precision made steel, corrosion-resistant lantern ring. Internal leakage is detected instantly in slush pumps through "tell-tale holes" before costly fluid cuts occur to cylinder walls. There is either a Tell-Tale Liner Packing Assembly or a "DIA-TEX" Sealing Ring available for all makes of slush pumps. Write for Catalog No. P-121.

LINER PULLERS



Save valuable time and labor

The Red Devil Liner Puller is a strong, heavy duty, dependable tool capable of pulling the most obstinate liner. Its operation is simple. There are no pins, connecting links or other small parts to bend, shear, break or become lost.

The "Universal Type" Puller (as illustrated) is designed for slush pumps. The "Expanding Grip Type" is designed for pulling thin wall-driven tube type liners, as used in small pumps. Write for Catalog No. P-122.

See Composite Catalog . . .
For more detailed information on Red Devil Products, see the Composite Catalog or write for special price catalogs noted above. Red Devil products are available through your supply store.

OIL WELL MANUFACTURING CORP.
6008 S. Alameda St., Los Angeles 1, Calif.

Bruno R. Schabarum, President of the Carl B. King Drilling Company, Midland, Texas, died June 11, on his return trip from the API Standardization Meeting in Colorado.

B. R. Schabarum

Schabarum, well known throughout the drilling world for his practical and technical contributions to the industry, as well as his activities as director of the American Association of Oilwell Drilling Contractors, Chairman of the Southwestern District of Production of American Petroleum Institute and technical advisor of Drilling Research, Inc., began his career with the National Supply Company in Toledo, Ohio, following graduation from California Institute of Technology in 1926. He remained with the company until 1942 in various positions in Tulsa and Fort Worth, having been liaison engineer between the field and factory, as well as sales manager of the Texas Division. In 1942 he became assistant to the president at Pittsburgh, where he was engaged in ordnance work for the armed forces. In 1944, he joined Carl B. King Drilling Company, where he began in engineering work; and in 1949 was promoted to general manager. He retained this position until his recent promotion to president of the company.

•

Fred McManis, 74, manager of W-K-M Company, died at his home in Houston. He was one of the original founders of W-K-M Company in 1919 and was active in the company until his death.

•

John J. Sheerin, 58, Texas and Oklahoma oil man, died June 8 in a San Antonio, Texas, hospital. He was a founder of La Gloria Corporation and served as vice president and director of the company until he resigned in 1945.

•

Clayton Reeves Lowe, 43, vice president of Independent Exploration Company, died at his home in Houston. He was a native of Louisiana and had been associated with the company since 1934. He was also assistant general manager of the organization. He was a graduate of Louisiana State University.

•

Dr. Joseph A. Sharpe, 45, president of Frost Airborne Survey Corporation and vice president of Frost Geophysical Corporation, died in Tulsa following a heart attack. Dr. Sharpe was a graduate of the University of Wisconsin. He studied for a year as a Rockefeller Foundation fellow at the Massachusetts Institute of Technology. He was associated with Western Geophysical Company in Los Angeles and Stanolind Oil and Gas Company before joining the Frost organizations in 1945.

•

Jessel S. Whyte, president and general manager of Macwhyte Company of Kenosha, Wis., died at his home in Kenosha May 28 following a prolonged illness. Whyte was born in Chicago and educated in the Chicago schools and Cornell University. He also studied at Sheffield University, Sheffield, England.

When SAND Is Your Problem Let LAYNE GRAVEL PACK Your Well

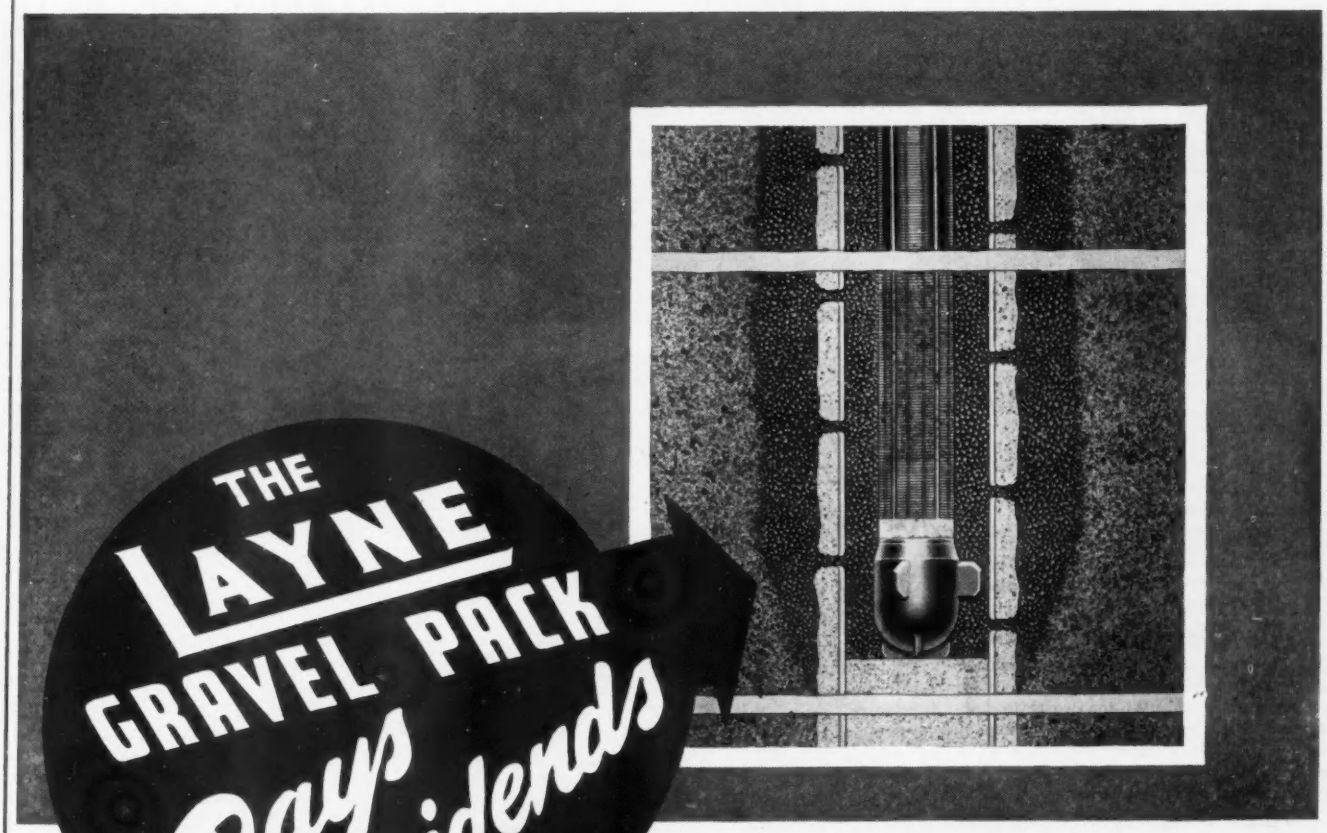
More and more Producers are finding "Gravel Pack" the answer to their most difficult sand problems—when it is done *RIGHT*.

The Layne & Bowler Company has the "KNOW HOW" at every depth.

Because the Gravel Pack can neither deteriorate nor enter the screen and because it permanently supports the formation and filters the flow, you are not confronted with the frequent expense of pulling tubing to replace sanded up screen and sand cut parts and other expenses involved in reworking wells.

Gravel Packing controls the productive sands. It surrounds the strainer with a natural filter, coarse enough for the oil to flow through, yet fine enough to retain the oil sand in its natural state of formation. Acting as a baffle, the gravel distributes the flow through the countless channels, lowering the velocity and preventing disruption of the fine grains of sand resulting in longer life for the well and equipment.

For longer, more constant flow of clean oil—let Layne & Bowler Gravel Pack your well.



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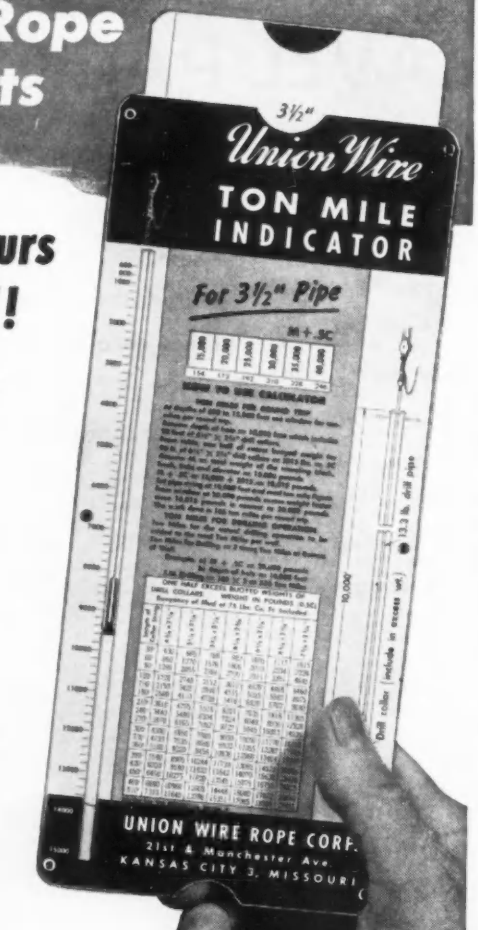
This Ton-Mile Indicator Helps Drillers Lower Wire Rope Costs



Mail Coupon for Yours Today . . . It's FREE!

Drillers—here is an easy, surer way to establish the correct time to cut off drilling lines. When you know this, you can prevent the overloading that reduces the ton-mileage a line gives you. And, you can more often avoid the line breaks that result in costly fishing operations.

The Union Ton-Mile Indicator is easy to use. With it you get a Union Log Book to help you keep your well records. To measure ton-mileage, all you do is set the figures from your log book on the indicator and read the answer. All the complicated figuring is done for you. Mail the coupon below to have yours delivered and demonstrated to you.

Send Coupon For Reprint of Above Oil Journal Article

The information in this article is based upon a 3 year research study covering 4 major oil regions. It discloses the waste in haphazard practices and guides drillers in setting up Definite Cut-off Procedure which will result in many more ton miles of service and save money on wire rope.

USE Tuffy® ROTARY LINES

They employ a unique construction and special steels to provide extra resistance to abrasion, drum crushing, shock loads and internal friction. Tuffy *Jackknife* Rotary Line is specially designed to move at higher speeds over the smaller sheaves and drums of the *Jackknife* rig. Tuffy *Standard* Rotary Line is designed for *Standard* rigs and for deeper drilling on *Jackknife* rigs. They are easy to order. Just specify Tuffy *Standard* Rotary Line or *Jackknife* Rotary Line, the length and the size. No complicated specifications.

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Gentlemen:
☐ Please have your field man deliver my Union Wire Ton-Mile Indicator and explain its use.
☐ Send reprint of Cut-off Proposal.

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City.....*Zone*.....*State*.....

Companies in the News

SINCLAIR OIL CORPORATION has opened additional company offices in Houston. **Harry A. Hassan,** vice president and director of Sinclair Oil & Gas Company and also vice president of Sinclair Refining Company, is in charge of the new offices.

H. A. Hassan

A veteran employe of Sinclair, Hassan has served the organization both in the U. S. and abroad. Sinclair said the Houston expansion was to give further impetus to its current program for increasing crude oil production and reserves in Texas and adjoining areas.

•

PANAMA-WILLIAMS COMPANY has been opened by **M. E. (Panama) Shiflett** and **M. S. Williams.** The company will engage in general pipe line construction. Offices are in the Melrose Building in Houston. Shiflett is former general superintendent of Anderson Brothers Corporation. Williams was formerly a vice president of the same organization.

•

SHELL OIL COMPANY will begin a major building expansion program designed to enlarge its present facilities in the Los Angeles office.

Under consideration in the long-range program are plans for an additional 18,000 square feet of office space, a roof-top lunchroom for employes, a large conference room for group meetings, and a new outdoor parking area.

•

RICHFIELD OIL CORPORATION has opened a Rocky Mountain Division office in Casper, Wyo., from which it will conduct an oil exploration program in the Rocky Mountain and Williston Basin areas.

Heading the new office as division geologist is **John H. Wiese,** assisted by **Ben W. Ryan, Jr.,** geologist. Both have been members of the Richfield staff for several years in the Northern Division office at Bakersfield, Calif.

The Casper office will supervise exploratory work in Montana, Wyoming, North Dakota, South Dakota, Utah, Colorado and Nebraska. Rocky Mountain Division operations will be complementary and adjacent to Richfield's exploration program in western Canada, announced in February.

•

WARREN AND BRADSHAW DRILLING COMPANY of Tulsa has changed its name to **WARREN-BRADSHAW EXPLORATION COMPANY.** This change was in line with the company's new expansion policy. The company also has announced two promotions and an addition to its personnel.

Oadus White, formerly division drilling superintendent at Oklahoma City, is now drilling superintendent. **King H. Reed,** former production foreman of the West Texas-New Mexico district at Odessa, Texas, has been made production superintendent. Both have been moved to Tulsa headquarters. **LeRoy F. Stewart,** consulting geologist of Fort Worth, is now head of the firm's newly organized exploration department with headquarters in Tulsa.

Associations

Pacific Coast API District Names T. H. Acres Chairman

T. H. Acres, of Sunray Oil Corporation, Los Angeles, was elected chairman of the American Petroleum Institute's Pacific Coast Production District at its 25th anniversary spring meeting.

Acres, who had been chairman for the meeting, succeeds Paul M. Andrews, of Signal Oil & Gas Company, Los Angeles, as the district chairman.

Other district officers are J. T. Crooker, Standard Oil Company of California, Taft, vice chairman, San Joaquin Valley area; Stafford Park, Fullerton Oil Company, Pasadena, vice chairman, Los Angeles Basin area; J. P. McCabe, Tide Water Associated Oil Company, Ventura, vice chairman, Coastal area; and John H. Van Deventer, of Cerutti-Thompson Company, Avenal, vice chairman, Coalinga-Kettleman area.

C. T. Reichert, of National Supply Company, Torrance, was re-elected treasurer and Mrs. Elsie Edmiston, of the American Petroleum Institute, Los Angeles, was re-elected secretary.

Penn Grade Association Names Streeter to Serve Fourth Term

Clarendon E. Streeter, Bradford, Penn., oil producer, has been elected president of the Pennsylvania Grade Crude Oil Association for a fourth one-year term.

Managing partner in Bradley and Streeter and Streeter Oil Company, he is an officer and director of Bradley Producing Corporation, Empire Gas and Fuel Company, Ltd., and Sterling Injection Molding, Inc. He is also a director of Texas Gulf Producing Company.

C. G. Johnson of Oil City, treasurer of Quaker State Oil Refining Corporation, was elected an assistant treasurer, succeeding W. R. Reitz of Oil City, president of the Quaker State Company.

Other association officers were re-elected.

Newly-elected directors are L. G. Lent of Bradford, member of the oil producing firm of Andrus, Lent and Daggett and president of the Bradford District Producers Association, and M. E. Mitchell of Wellsville, N. Y., president of the New York State Oil Producers Association.

UT Professor Chairman

Dr. Harry H. Power, University of Texas petroleum engineering professor, is the new chairman of the American Institute of Mining and Metallurgical Engineers' Mineral Industries Education Division.

During 1952-53, the division will seek ways to fill the unprecedented demand for mineral industries engineers and to push research toward better utilization of the nation's mineral supplies, Dr. Power said.

Houston Petroleum Accountants Organize, Name Group Officers

Thirty-three accountants representing a cross-section of the petroleum industry have organized the Petroleum Accountants Society of Houston. R. E. Lee, The Texas Company, was chosen as the group's temporary chairman.

Other officers are George N. Clawson, of F. A. Callery, Inc., vice chairman; and C. Howard Phiffer, of L. D. Cain Drilling Company, secretary-treasurer.

Temporary directors are E. A. Armentrout, Oil Drilling, Inc.; F. L. Freitag, Tennessee Production Company; L. A. Patillo, Union Producing Company; and Virgil Smith, Superior Oil Company.

Members of the Steering Committee are A. S. Hagen, Shell Oil Company; E. M. Jacobs, The Texas Company; and D. M. Withers, Stanolind Oil and Gas Company.

American Gas Association Picks St. Louis for 1953

The 35th annual convention of the American Gas Association, which is expected to attract 5000 delegates, will be held in St. Louis the week of Oct. 26, 1953. Site of the convention was recommended by a committee headed by Oliver S. Hagerman, chairman of the board, United Fuel Gas Company, Charleston, W. Va. The committee's report was approved by the AGA executive board in New York City. The 1952 convention will be held the week of Oct. 27 in Atlantic City, N. J.

SOUTHERN GAS ASSOCIATION officers for the new term are, left to right, J. C. Flanagan, of United Gas Corporation, vice chairman, Advisory Council; J. H. Wimberly of Houston Natural Gas Corporation, president; and H. K. Griffin, Mississippi Gas Company, first vice president.

Increased Exhibit Space Made Available for Petroleum Show

More than 35,000 square feet of outside exhibit space has been added to International Petroleum Exposition facilities for the May 14-23, 1953, show, exposition general manager William B. Way announced.

Exposition improvements will include leveling and grading the additional land, putting in roads and walkways, installing water, gas and electric lines, and drainage facilities.

Exposition building and grounds committee members are Frank J. Hinderliter, chairman; D. D. Bovaird, Barton A. Myers and Way.

Robert H. Dott Is Installed As AAPG Executive Director

Morgan J. Davis, president of the American Association of Petroleum Geologists, announced that Robert H. Dott of Norman, Okla., is the new executive director of the association. From his Tulsa headquarters, Dott will direct all AAPG activities, and especially preparation of new books and special volumes on problems and methods of petroleum geology.

John W. Clark, assistant chief geologist of Magnolia Petroleum Company, Dallas, has been appointed secretary-treasurer to serve out the unexpired term of Dott.

Dott has been director of the Oklahoma Geological Survey since 1935. He received the B.S. degree in 1917 and A.M. in 1920 from the University of Michigan.

Clark, who has been with Magnolia 22 years, is a graduate of Princeton University and did graduate work at the University of Chicago.

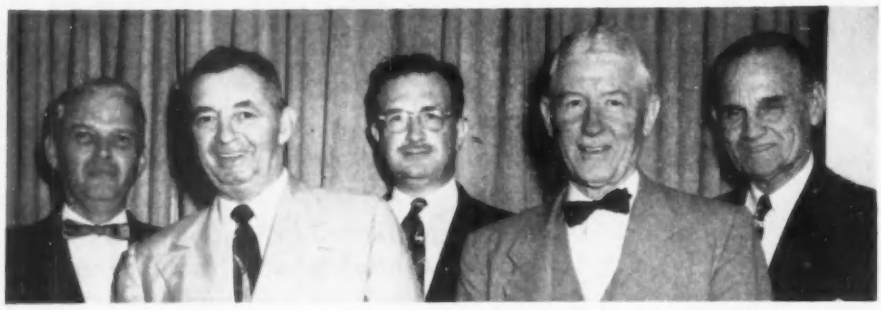
J. P. D. Hull and E. W. Ellsworth continue as business manager and assistant business manager.

Lyons Heads Officer Slate of Tulsa Geophysical Society

Paul L. Lyons, exploration manager for Anchor Petroleum Company, Tulsa, and editor of *Geophysics*, quarterly publication of the Society of Exploration Geophysicists, has been elected president of the Geophysical Society of Tulsa, succeeding R. W. Gemmer, chief geophysicist for The Carter Oil Company.

Other new officers are L. Y. Faust, Geophysical Research Corporation, first vice president; W. B. Agocs, consultant, second vice president; D. R. Davis, Industrial Electronic Supply Company, secretary; Francis H. Cady, Carter, treasurer; and E. V. McCollum, E. V. McCollum and Company, district representative to the national society.

Reese H. Tucker, Cities Service Oil Company, and R. G. Piety, Phillips Petroleum Company, both of Bartlesville, continue to represent the Tulsa district on the national committee.



NEW OFFICERS AND DIRECTORS elected by the Association of Well Head Equipment Manufacturers are, left to right, B. V. Fisher of Rector Well Equipment Company, secretary and treasurer; L. L. Rector of Rector Well Equipment, director; A. T. Lawrance of Beaumont Iron Works Company, president; E. L. Lorehn of Cameron Iron Works, retiring president; and L. D. Hilton, executive secretary. Donald U. Shaffer of Shaffer Tool Works is vice president. Directors are L. L. Garber of Hinderliter Tool Company, Thomas J. Regan of Regan Forge and Engineering, Glenn Johnson of Baash-Ross Tool Company, and Lawrance, Lorehn, Rector and Shaffer.

Committees Named to Arrange For Midwestern SEG Meeting

Appointment of Richard Brewer, of The Atlantic Refining Company, Shreveport, as general chairman of the sixth annual midwestern meeting of the Society of Exploration Geophysicists was announced by F. G. Knight, of The Ohio Oil Co., president of the Ark-La-Tex Geophysical Society, Shreveport. The meet will be held November 13-14 in Fort Worth, and will be sponsored by the Fort Worth, Dallas, Midland, Tulsa and Shreveport local sections of the SEG with the Shreveport group in charge of arrangements.

Leslie C. Spencer, consulting geophysicist and secretary-treasurer of the Ark-La-Tex society, is chairman of the technical program committee for the meeting, and will be in charge of accepting papers for presentation. B. B. Burroughs, of Sunray Oil Company, vice president of the Ark-La-Tex society, is chairman of the housing committee, and will be assisted by F. O. Mortlock, of Gulf Research and Development Company, Fort Worth. Other committee chairmen in Shreveport are Bryan Duby, of The Carter Oil Company, finance committee; Roy Fischer, consulting geophysicist, entertainment committee; and E. A. Malone, of Gulf Research, registration committee.

Houston Chapter API Awards Two Petroleum Scholarships

Sam H. Davis, Jr., senior chemical engineering student at Rice Institute, and Royal Jay Cristensen, senior petroleum engineering student at the University of Houston, were awarded scholarships by the Houston Chapter, American Petroleum Institute.

Davis, a member of Phi Beta Kappa, Tau Beta Pi, Phi Lambda Epsilon, Student Chapter AIChE and American Chemical Society, has worked as a roustabout in the Katy Cycling Plant operated by Humble Oil & Refining Company.

Cristensen is a member of Sigma Gamma Epsilon, and Student Chapter AIME.

IPAA Meeting Dates Changed

Annual membership meeting of the Independent Petroleum Association of America will be held Friday and Saturday, October 24-25, at the Skirvin Hotel, Oklahoma City. The meeting previously was planned to be held October 20-21 in Tulsa.

Swearingen Given New Job With Research Institute

Dr. Judson Swearingen, known for his work in uranium plant construction during the war, has been named director of petroleum technology for Southwest Research Institute.

Dr. Swearingen

A veteran member of the staff of the scientific research organization, Dr. Swearingen has been the institute's chairman of chemical engineering and one of its key scientists and engineers almost since it was founded in September, 1947.

Prior to joining the staff, Dr. Swearingen, who serves also as technical advisor to the nonprofit industrial research laboratory, was a consulting chemical engineer in New York City.

The scientist received his doctorate from the University of Texas. He is a member of the American Institute of Chemical Engineers, the American Chemical Society and the Southwest Research Institute branch of the Scientific Research Society of America.

California Producers Name President to Second Term

D. T. Staples, executive vice president and a director of Pacific Western Oil Company, vice president and a director of Mission Corporation and of Mission Development Company, has been re-elected president of the Oil Producers Agency of California.

Rush M. Blodget, executive vice president of the organization for 20 years, has retired and has been succeeded by Stark Fox. Fox was Blodget's assistant for many years and more recently has been a vice president.

Other officers elected are Wm. S. Comstock, Franco-Western Oil Company, W. H. Geis, consulting engineer, and R. A. Grant, Fullerton Oil Company, vice presidents; W. A. Russell, Seaboard Oil Corporation, secretary-treasurer; and Verne Harrell, Bankline Oil Company, assistant secretary-treasurer.

Petroleum Industries Group Appoints Two New Members

Two new members of the American Petroleum Industries Committee are Lloyd F. Thanhouser, vice president and general counsel of Continental Oil Company, Houston, and Rayburn L. Foster, vice president and general counsel of Phillips Petroleum Company of Bartlesville, Okla.

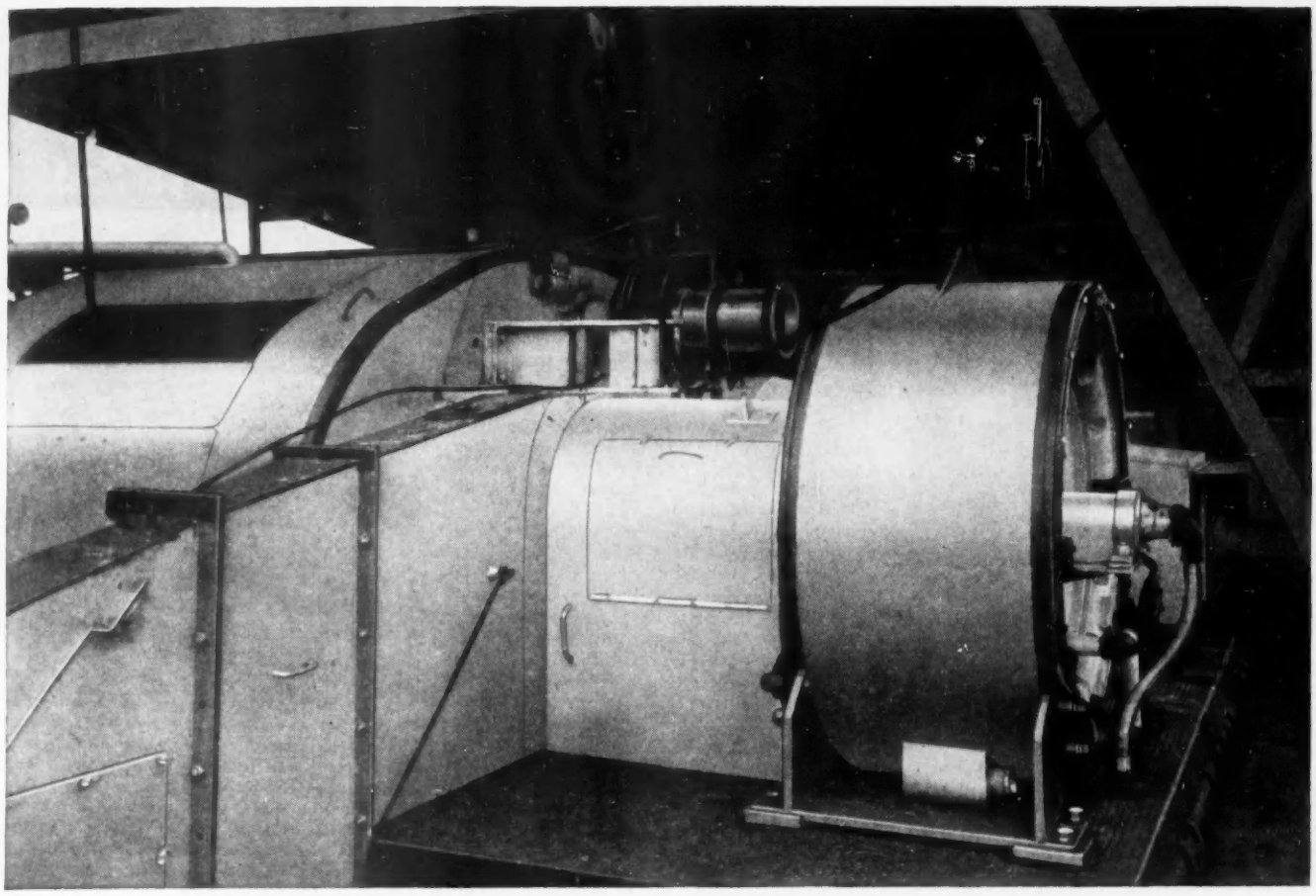
Thanhouser succeeds James J. Cosgrove, former general counsel of Continental. A Yale University graduate, Thanhouser was with Satterlee and Canfield, law firm, and a partner in the firm of Satterlee, Warfield and Stephens, before joining Continental.

Foster, a University of Oklahoma graduate, began private practice in 1916 and became attorney, Independent Oil and Gas Company, in 1928. With Phillips, he began as staff attorney and rose to vice president.

Illinois Oil Men Plan Outing

The annual mid-summer Oil Men's Outing of the Illinois Oil and Gas Association and the Illinois Basin Chapter API will be held July 18 in Centralia, Ill. It will consist of a golf tournament in the morning, technical discussions by the API in the afternoon, and a secondary recovery panel and committee reports by the Illinois Oil and Gas Association in the evening.

NOMADS IN CHARGE of the Los Angeles Chapter Whing Ding to be held at the Riviera Country Club July 11 are pictured at a committee meeting. Back row, left to right, are I. B. (Babe) Doyle, Hydril Company; W. H. (Bill) Sargent, Sargent Engineering Company; Ray Humphreys, Axelson Manufacturing Company; Jerry Engstrand, Grant Oil Tool Company; and Vern Mitchell, Security Engineering Company. Front row: George Gutekunst, Gardner-Denver Company; H. J. (Joe) Schlarb, Chiksan Company; W. F. (Bill) Bettis, Johnston Testers, Inc., and Leo Cypher of Baash-Ross Tool Company. Not shown are John Flanagan of Johnston Testers and Dick Winder of Chiksan.



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Equipment and Service Suppliers' Notes

H. C. Brand

L. A. Allaud

Schlumberger Announces Changes In Field Personnel and Divisions

Several changes have been made in the field management personnel of the Schlumberger Well Surveying Corporation.

H. C. Brand has moved from his post as assistant area manager at Tulsa to North Central Texas division manager at Dallas. Brand, a graduate of the University of Tennessee in electrical engineering, has been with Schlumberger since 1939.

L. A. Allaud, who recently returned from a four-year period of service with Schlumberger Surenco, S. A., in Venezuela, has been made assistant area manager of the newly created Northwest Texas Area under the direction of J. A. Bodin.

M. L. Millican has been transferred from Kermit, Texas, to Midland, where he is district manager. Millican joined Schlumberger in 1947 after graduation from the University of Texas as a petroleum engineer.

Replacing Millican at Kermit as district manager is J. W. Little. Little obtained his education at Tulane University and was employed by Schlumberger as a field engineer in 1948.

J. L. Heath leaves his position as district manager at Kenedy, Texas, to take the same position at Wichita Falls. Heath, employed by Schlumberger in 1947, was trained in petroleum engineering at the University of Texas.

Filling the district manager position at Kenedy is J. B. Markolf who moves from Columbus, Texas, where he opened the new Columbus district office last November. Markolf attended the University of Nancy in France and joined Schlumberger in 1947 as a field engineer stationed at Beaumont, Texas.

Lee Petty has been made district manager at Columbus replacing Markolf. Petty is a graduate of Texas A. & M. College and has been stationed at Beaumont and Wharton, Texas since 1947.

J. C. West has been transferred from Tyler, Texas, where he has been field engineer, to the management of the district office at Magnolia, Ark. West attended the Colorado School of Mines and has been with Schlumberger since 1946.

C. F. Schwab takes over the duties of resident engineer at the Mt. Pleasant, Mich., station. He graduated from the Missouri School of Mines and Metallurgy in 1941. He joined Schlumberger as a field engineer at Beaumont.

Moving to the headquarters staff at Houston are R. P. Alger and J. S. Kellough. Alger comes from Magnolia, Ark., to join the operations department in Houston as assistant to the chief field development engineer. Alger is a graduate of the Missouri School of Mines and Metallurgy. J. S. Kellough enters the engineering department at Houston. Kellough holds a Master of Science degree in physics from the University of Iowa. He joined the Schlumberger organization in 1937.

Kenton Chickering

M. F. Jones

Jones and Chickering Advanced to Area and General Sales Positions

Melvin F. Jones has been promoted to manager of the Gulf Coast area of U. S. Steel's Oil Well Supply Division, and has been succeeded as manager of the general sales staff at Dallas by Kenton Chickering. Chickering was formerly manager of the Commercial Research section.

Jones succeeds F. D. Smith, manager of the Gulf Coast area for the past four years, who has been transferred to Dallas as assistant to the general manager of sales.

Jones, who has been with "Oilwell" 23 years, will have charge of all field stores and warehouse operations in Southwest Texas, Southeast Texas, Southern Louisiana and Mississippi.

Chickering joined the firm in 1928 after graduation from Lehigh University. From 1933 to 1944 Chickering was "Oilwell's" advertising manager.

HOMCO Opens Office in Denver

Houston Oil Field Material Company, Inc., opened an office in Denver. C. L. Roach became the HOMCO representative for that area.

WELL EQUIPMENT MANUFACTURING CORPORATION, division of Chiksan Company, this year held its two-day general sales meeting in Odessa, Texas, more than 500 miles away from the home office in Houston. The meeting was held in West Texas so that representatives could see the new Chiksan "Hose-Saver" and All-Steel Rotary Hose in use, and also so they could observe operations in one of the most active areas in the U. S. Pictured at a rig location are, left to right, John W. Gates, sales manager of Weco; G. W. Winder, Chiksan sales manager, Brea, Calif.; A. H. Watts, Weco representative, Graham, Texas; Frank Wiegand, Chiksan field engineer; Walt Berntsen, Chiksan sales; Gus M. Bagnard, Chiksan chief engineer; J. C. McCelvey, Weco, Odessa; Bev Ragsdale, Chiksan, Salt Lake City; Bill Brien, Weco, Houston; Roy Shields, Weco, Baton Rouge; Eli Parker, Weco, Lafayette, La.; Bill Hull, Weco, Russell, Kansas; Jack Runnel, Chiksan, Edmonton, Alberta, Canada; Durk Durkin, Weco, Hobbs, N. M.; Pete Bily, Chiksan product development engineer; and J. H. Robinson, Weco general manager.

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Model E-563 WINCHES. . .

ONLY COOPER--ALLIS-CHALMERS WINCHES

Offer All These Advantages

1. Unique design of motor mount permits proper distribution of load on truck or trailer.
2. Low center of gravity, note that height of unit is no more than height of truck cab and mast clears cab by inches. It's safe and easy to road.
3. Height, width, weight and length meet most exacting road regulations.
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5. It has heavy tractor type 4 speed transmission, built to take the high torque of the Allis-Chalmers engine.
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7. Brakes are Cooper patented Air Cooled self-energizing, alloysteel, and center mounted to compensate for expansion. Built in two sizes—36" dia. x 6" wide, or 42" dia. x 8" wide.
8. Eight Line speeds on drum from 47' pm to 815' pm and a maximum line pull of 38,000 lbs. on single line.
9. Line Capacity on 42" drum is 8,600' of ¾", on 36" drum, 6,600 of ¾".
10. All Steel truck bed with plenty of room for air compressor and tools.
11. Telescoping mast with rod hanger and tubing board, which automatically swing into position as mast is raised. Locking dogs automatically lock upper section in place and are tripped from the ground when lowering—No need for a man to be on the pole when setting-up or lowering mast.
12. Mast can easily be dis-connected from unit and left standing and winch unit can be removed from truck in a matter of minutes.

The COOPER—ALLIS-CHALMERS line of servicing winches offers a wide selection of models and sizes. Four sizes of self-propelled tractor units for servicing to 10,000' with one or two drums, six sizes of truck, trailer and skid winches, work-over and drilling rigs with one, two or three drums. There is a proper size for any depth.

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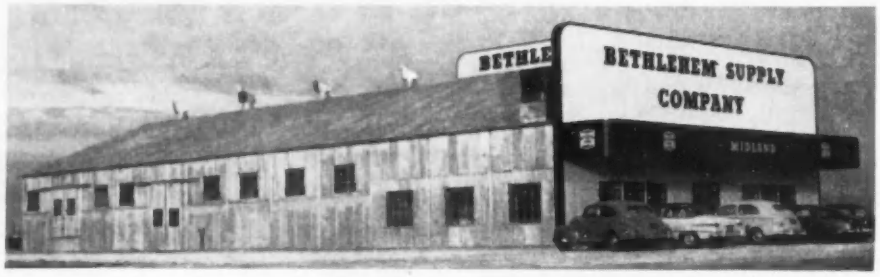


Bethlehem Supply Company's new store at Midland.

Supply Store at Midland Opened To Serve Eastern Permian Basin

Bethlehem Supply Company has opened a store at Midland, Texas, to serve the Spraberry area in the eastern sector of the Permian Basin. Complete stocks of drilling, production, refining and pipe line supplies will be maintained.

B. K. Smith

B. K. Smith, who has been in charge of the Snyder, Texas, store, will be store manager at Midland. The store is under the supervision of District Manager W. A. LaRew of Midland.

25 Years of Industry Service Are Marked by Oil Center Tool Company

Twenty-five years ago, Oil Center Tool Company began business in Houston in a small machine shop measuring 18 x 20 feet. Today, the company's plant occupies more than 50,000 square feet of floor space, with further expansion underway.

O-C-T was founded by Arthur J. and Kirby T. Penick as a small machine shop intended primarily to do special work for Houston firms with heavy industrial equipment. A third brother, Edward Penick, was bookkeeper for the small concern, and the first employe was Fritz Richard, who has been vice president since 1931.

The company soon began manufacturing high pressure oil field equipment, the field in which it was to specialize. In 1930, during the East Texas oil boom, O-C-T devised a way to eliminate well site assembly of christmas trees, putting them together instead at the Houston plant and shipping the completed units to East Texas for installation.

As O-C-T supplied more and more of the specialized equipment needed for deeper wells and greater pressures, the company moved to its present location on Airline Drive in Houston in 1936. The new plant site was chosen to allow for future expansion, and the foresight of the Penick brothers in selecting it continues to pay dividends.

Expansion of markets was launched in 1946 under a new president, John Maher, and under his leadership, sales volume has increased 250 percent.

O-C-T products are distributed exclusively through supply stores, and the firm claims to be the first manufacturer of wellhead equipment to adopt this distribution policy.

Lane-Wells Reports 15 Additional Service Installations in 1951-52

Lane-Wells Company increased the number of locations by 15 in 1951 and 1952, and now has 66 technical oil field service points. Ten new stations were added in the Gulf Coast, Mid-Continent and Pacific Coast divisions in 1951, and five more since January, 1952.

Haskell Truck Station, under the supervision of Harry Johnson, was opened at Haskell, Texas. Sales Engineer A. W. Cook also works in the North Central Texas District.

E. M. Eddings, Jr., is in charge of the new truck station at Freer, Texas.

In West Texas, E. W. Sutton, Jr., is operator in charge of the McCamey, Texas, Truck station. and N. J. Whitman is superintendent of the one at Monahans.

In the Mid-Continent division, the company has opened its first branch in North Dakota. Ernest H. Winer is operator in charge of the Williston station.

Henry H. Paris Is Distributor of Gorman-Rupp Pumps to Oil Industry

Henry H. Paris Distributor, Inc., has been named to establish an oil field warehouse service to handle Gorman-Rupp pumps and parts in the Mid-Continent and Gulf Coast areas. The Paris organization succeeds the late Tom L. Turner.

A program of factory training in both sales and service is in progress for all Paris personnel. The organization has added a new warehouse at 1125 Rothwell Street in Houston to stock Gorman-Rupp products.

Wichita Falls Magazine Features Story of Wilson Manufacturing

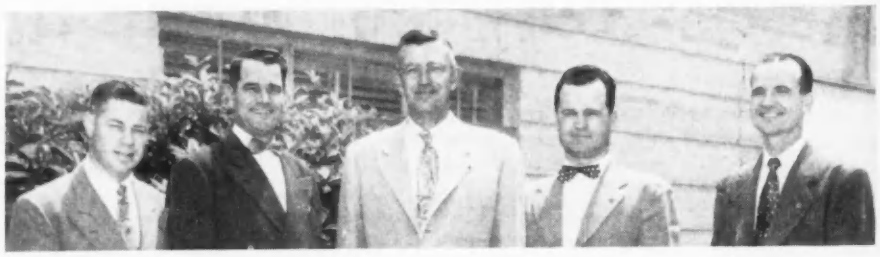
The story of Wichita Falls' largest industry, Wilson Manufacturing Company, and John Wilson, the man behind the company, is told in the Spring issue of the Chamber of Commerce magazine, *Wichita Falls*.

Wilson's career in engineering, as a designer and manufacturer of drilling equipment, is related, along with the story of his accomplishments in civic affairs.

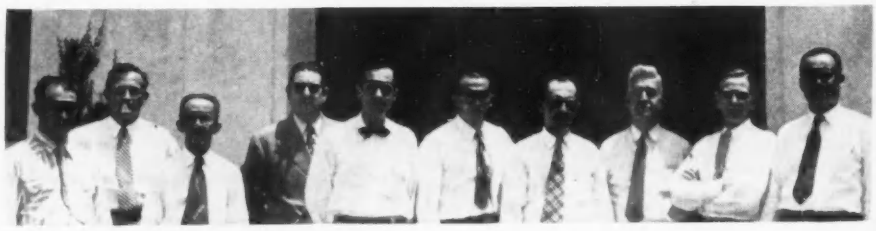
Col. Rockwell to See European Plants

Colonel W. F. Rockwell, chairman of the board, Rockwell Manufacturing Company, left New York on May 29 by plane for Europe where he expected to visit at least five plants in England, France, Italy and Germany which are now manufacturing Rockwell products.

Rockwell revealed that two new agreements are being negotiated on this present trip which call for the products to be manufactured under the Rockwell trade name.



ATTENDING OTIS PRESSURE CONTROL'S semi-annual home office conference for division service managers and sales officials last month in Dallas were, left to right, Curtis A. Kizer of New Iberia, engineering consultant for the southern Louisiana region who formerly was stationed in Dallas as a sales engineer; Guy W. Gant, recently assigned as a senior sales engineer for the Gulf Coast-South Texas area headquarters in Houston and former division service superintendent in Houston; Turner G. Garwood, Dallas, sales manager, formerly senior engineering consultant for the Gulf Coast area with offices in Houston; K. W. Robbins, formerly chief corrosion engineer in the calipering department in Otis' Houston office, now engineering consultant for the northern and western parts of the Mid-Continent area, and P. B. Loper, Dallas, former office manager in Houston, who heads Otis' advertising and sales promotion department.



EMPLOYES FROM THE CARACAS OFFICE of Socony-Vacuum Oil Company of Venezuela visited the Houston plant of Mission Manufacturing Company as one of the stops on their tour of important U. S. industrial plants. Pictured at the Mission plant are, left to right, Alberto Marin of Socony Vacuum; Jack Stewart, Mission; Luis Biaggi, Socony; W. T. Campbell, Mission; R. N. Ross, Magnolia Petroleum Company; Augustin Millan and Pedro Campos, Socony; F. S. Mims, Mission; and George Kendall and Miguel Golindano, Socony.

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TULSA, OKLAHOMA

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SECONDARY MODERN RECOVERY
TECHNICAL CONSULTING
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SERVICE, INCLUDING
CORE ANALYSIS
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CABLE ENGINEERING
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Do You Need a Good New Source of Metal Stampings for Defense Contracts?
Kelley has the facilities, the know-how, and the men to do your job and to do it right. From start to finish Kelley is your one source—to help you engineer stampings, to design and make the tools, and, most important, to deliver the job to your specifications on time. Kelley cut its teeth in oilfield equipment, uses that experience to make your job better.
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EQUIPMENT and SERVICE SUPPLIERS' NOTES

McCULLOUGH TOOL COMPANY opened a new branch office at Sherman, Texas, Eastern division, by giving an open house and barbecue attended by representatives of oil companies, independent operators, drilling contractors and service companies. The Sherman branch will serve the Gainesville area, the Sandusky area and Southeastern Oklahoma. Company personnel at the new branch include, left to right, J. E. Mitchell, branch manager; C. R. Robertson, district manager, Wichita Falls; Durwood Green, branch salesman; Dub Barton, service operator; A. C. Lane, operating engineer; R. W. Smith, director of public relations, Houston; and Richard Heine, service operator.

KEYSTONE TOOL CORPORATION executives and employes are pictured at the annual sales meeting in Houston. In addition to periods devoted to the discussion of Keystone products and their application, daily luncheons were held at which the group was addressed by members of the petroleum industry. Visitors at the meetings included L. S. Hamer, president of Hamer Oil Company, and W. D. (Bill) Owsley of Halliburton Oil Well Cementing Company.

Glen and Powell Get New Executive Assignments in Emsco Organization

Hugh H. Glen, president of Emsco Derrick & Equipment Company since 1939, has been elected chairman of the board. William T. Powell, executive vice president, has been elected president. Both changes become effective July 1.

A. A. Ashton

A. A. (Al) Ashton, designer of Emsco Derrick & Equipment Company's first G Series drilling rig, has been made chief engineer of the company.

Powell has been associated with Emsco for the past 14 years. In 1942 he was elected vice president and placed in charge of manufacturing. Subsequently, he directed both manufacturing and engineering activities of Emsco. Last December he was elected executive vice president.

Ashton joined Emsco, in Los Angeles, in 1936. He was in the Tractor Equipment division of Emsco for two years and then was transferred to the Oil Field Equipment division as a designer.

In 1940, he was moved to Emsco's Houston plant as assistant chief engineer. In 1943, he was promoted to chief mechanical engineer, and in 1950 to chief engineer of the Houston plant, combining the Machinery and Structural divisions.

William T. Powell

Hugh H. Glen

Standco
NO-SMOKE
STANDCO BRAKE LINING
Nothing novel—no bunk, but it gets the job done without scoring brake rims. See pages 3973-3978 Composite Catalog.
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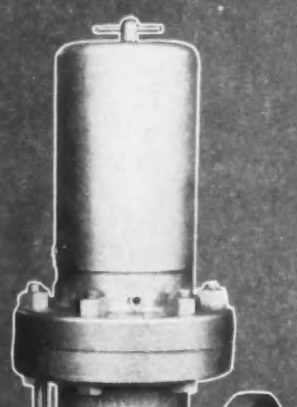
Instant Full-Open Relief of Excessive Pressures

KINZBACH
Model 412 Relief Valve



Among the design features that have brought about the immediate acceptance of the Model 412 Valve with pipeline and refinery engineers everywhere is its ability to open instantaneously to full capacity when the pressure overload in the line is reached, thus providing maximum relief when it's most needed.

Other important features include Automatic Resetting, at a pre-determined pressure drop, Positive Seating, and facilities for Functional Testing.

Model 412 utilizes line pressure for opening and closing. Opening pressure is easily pre-set by the application of a dead-weight load. Action is positive and reliable—the pre-set pressure never changes.

For absolute safety and dependability, use them at strategic points on your hydraulic systems. Available in 2", 3", 4", 6" and 8" sizes, for working pressure up to 1000 p.s.i.

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EQUIPMENT and SERVICE SUPPLIERS' NOTES

Front entrance of Oil Well Supply Division's new California area headquarters at Vernon, Calif.

"Oilwell" Announces Completion of Big California Expansion Program

Completion of an extensive program of facilities improvement and personnel appointments in the California area, aimed at extending its supply activities to meet the increasing needs of the California oil industry, was announced by Donald S. Grubbs, California area manager of U. S. Steel's Oil Well Supply Division.

Climaxed by the opening of a large new unit at Vernon, Calif., in which the headquarters offices of the California area have been moved, the program includes the establishment of a new field store, construction of a new building for a second store and remodeling two other stores.

The new address of the California area headquarters is 4900 South Santa Fe Avenue, in Vernon. They formerly were in Los Angeles. The offices occupy 5600 square feet and are housed in a 54,000-square-foot structure which has been remodeled to accommodate large stocks of machinery and supplies and a big repair shop. The new brick and steel building is on a two-acre plot, with a paved storage yard of more than 26,000 square feet.

The new "Oilwell" store has been opened at Castaic Junction in a new building. James Doan, formerly manager of the Ventura store, is store manager. At Ventura a new building also has been constructed on Ventura Avenue and Nelson Harpold has been named to succeed Doan as store manager. The Bakersfield store has been enlarged and improved and two members have been added to the sales staff, Arne Johnson and Amos Cooke. Store manager is Carl L. Schwab, Jr. In addition, the Long Beach store, whose manager is C. R. Malone, has been remodeled, and at the Taft store Paul Paulsen has been added to the sales staff.

Further organizational changes in California include the appointments in the area headquarters offices of R. T. Watkins as engineer, Eric Lemke as manager, drilling equipment sales, and John Brown, office manager. "Oilwell's" city sales staff in Los Angeles has also been expanded with the addition of Tom Hill and Norman Kirkland.

EQUIPMENT and SERVICE SUPPLIERS' NOTES

HOME FROM A ROUND-THE-WORLD TOUR are Mr. and Mrs. John B. O'Connor, who covered 28,000 miles in their nine-week trip. O'Connor, executive vice president of Dresser Industries, Inc., reported that oil companies in the Far East are making definite progress despite tremendous operating difficulties, but "in Burma, Malaya and Indonesia, however, it looks as if it might be quite some time before operations can be carried on with any real degree of safety." O'Connor visited many business associates in Hawaii, Japan, the Philippines, Hong Kong, Singapore, Siam, Java, Kashmir, Pakistan, Israel, Germany and France. Traveling with the O'Connors were the Charles Rowans, of Rowan Drilling Company, Fort Worth.

Milwhite Mud Sales Firm Organized To Distribute Line of Chemicals

Henry David, president and general manager, announced formation of a new corporation, Milwhite Mud Sales Company, to distribute and service a complete line of mud and chemicals. With headquarters in the Cotton Exchange Building, Houston, the organization includes 44 stock points and 30 service engineers.

Henry David

Assisting David in the Houston office are E. Holy, office manager and purchasing agent; Sam Harper, public relations and sales; R. C. Biering, city sales and export sales; Bob Jung, Houston area chief engineer; and David Rowe, research and development.

The West Texas division is headed by Jerry Cunningham, division manager with Ken Ballard, sales manager; W. L. Smith, assistant sales manager; and Dick Ladd, division chief engineer.

The Louisiana area is headed by Ed Cadena, division manager and chief engineer.

Brown Named by Mission in Kansas

J. H. (Henry) Brown of the Mission Manufacturing Company has been appointed their sales representative in the Russell, Kansas, area. Brown was formerly with Continental Supply Company.

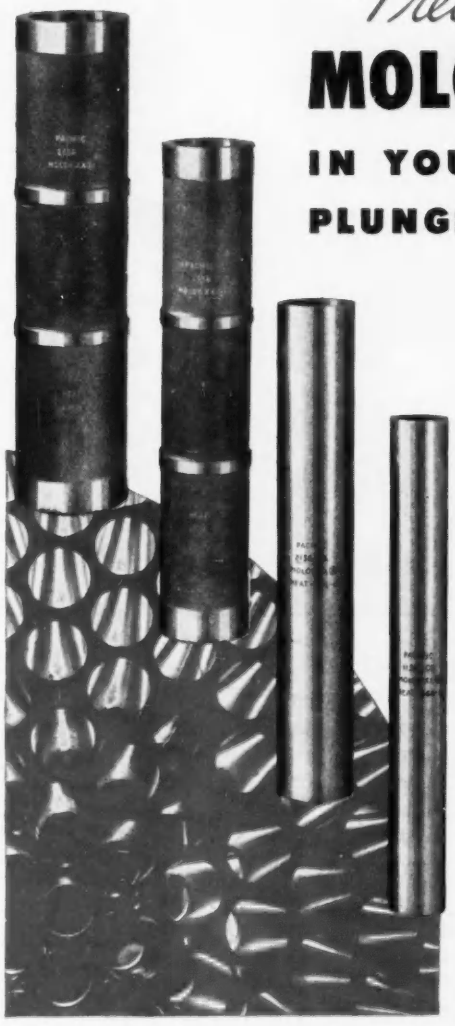
TO DECREASE YOUR COST OF PRODUCTION SIMPLY INSTALL

Pacific

Precision Built

MOLOY ® LINERS

IN YOUR OIL WELL PLUNGER PUMPS



MOLOY—® a ferrous alloy developed by Pacific primarily for oil well plunger pump liners has all the qualities for long economical life in your well. Strength, toughness, hardness combined, give MOLOY greater resistance to temperature, corrosion and abrasion than ordinary iron liners.

MOLOY—® LINERS are precision controlled at every step from the electric furnace to the final heat treatment to insure perfect castings of uniform chemical and physical characteristics.

MOLOY—® LINERS are precision finished to extremely narrow tolerances. You receive the full benefit of this precision finish because the uniform structure and, above all, the stability of MOLOY ® prevents the liners from warping after machining operations are completed.

IN FIELD AFTER FIELD, THE STRENGTH AND DURABILITY OF MOLOY—® LINERS HAS REDUCED PRODUCTION COSTS AS MUCH AS 50%

PACIFIC *Precision Built* PUMPS

Pacific Pumps inc.

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Leads Again with

PRE-TESTED UNITS

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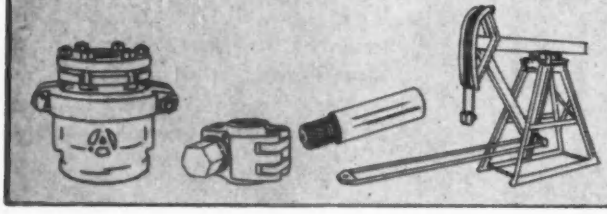


Buy Alten Oil Field Pumping Equipment at Your Local Supply Store.

Alten sets a new pattern of progress and performance in the industry by thoroughly pre-testing every pumping unit sold. Extra care in building plus constant engineering improvement means less down time and more fluid pumped at less cost. You can be sure every Alten unit will perform to its full rated capacity.
Constant quality control—not spot checking—rules Alten production. Component parts are thoroughly inspected at every phase of manufacture. Particular attention is given gear trains—the very backbone of the unit. Each is placed in operation and has to prove itself in tests that meet the challenge of harsh operating conditions. Any discrepancies are uncovered before the unit reaches the field.

ALTEN

Foundry & Machine Works, Inc.

LANCASTER, OHIO

EQUIPMENT and SERVICE SUPPLIERS' NOTES

A. T. LAWRANCE, president of Beaumont Iron Works Company, right, explains the workings of the Beaumont plant to T. L. (Doc) Fontaine, president of Atlas Engineering Works, at the first annual oilfield equipment sales meeting of the two companies. Atlas Engineering is sales agent for the Beaumont company. The meeting was attended by engineering and manufacturing personnel of Beaumont Iron Works and sales personnel from Atlas Engineering.

Dowell Announces Several Changes In Sales and Management Staffs

Three new appointments have been made in the sales and management staff of Dowell Incorporated.

Receiving the different assignments are

R. D. Shaw

Marshall Stirling

R. D. Shaw, Tulsa; Marshall Stirling, Fort Worth, and W. N. (Woody) Estel, Tulsa.

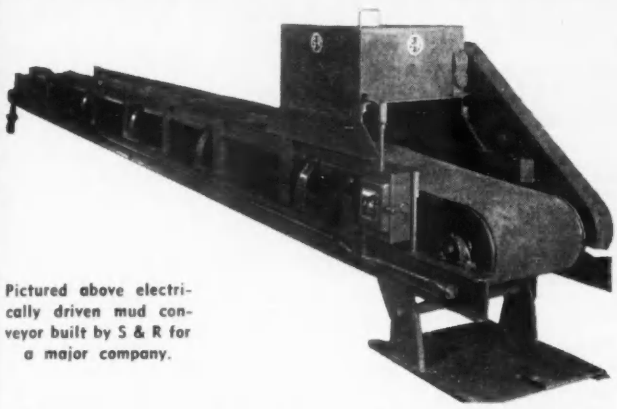
Shaw, who moved to Tulsa in 1933 as general sales manager of Dowell, has been named director of sales, a newly created post in Dowell.

Stirling, sales manager of the Petroleum division of Dowell with offices in Fort Worth, will move to Tulsa as general sales manager replacing Shaw.

W. N. Estel

Estel, who has been sales development manager, has been promoted to assistant general manager and will be directly responsible for an entirely new department of employe-public relations which is now being organized.

S & R SPECIAL *Custom Built* MUD CONVEYORS FOR DRILLING BARGES



Pictured above electrically driven mud conveyor built by S & R for a major company.

Here's the answer to efficient movement of mud for your drilling barge—it's S & R's custom built electrically powered, chain drive mud conveyor.

Built for heavy duty service with quality materials equipped with reversible belt, troughing idlers, protected easily accessible drive housing. Operates efficiently all positions to 35° off horizontal. Built in sizes to 40 feet.

Write, wire or phone for additional information

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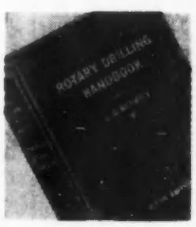
P. O. Box 1755 155 McCarty
HOUSTON 1, TEXAS
Export: 42 Broadway, N. Y. 4, N. Y.

New Revised and Enlarged Fifth Edition

Rotary Drilling Handbook

By J. E. BRANTLY
Past President, American Assn. Oilfield Drilling Contractors and President, Drilling & Exploration Co.



On the Rig, in the Field, at the Desk Every Oilman needs this book to check operations if planning a major drilling campaign or for its charts, reference tables and engineering data on the rig. Improved techniques and new drilling equipment required a complete rewriting of this standard authoritative work. 702 pages including 206 pages of tables and charts, a glossary and diagrams; profusely illustrated; fabricoid cover. Price $10.00.

Send orders to

The GULF PUBLISHING COMPANY
P. O. Box 2608
HOUSTON, TEXAS

If the equipment you make or use presents really tough bearing application problems—involving abnormal shock and impact loads, constant subjection to dirt or dust, or other murderous operating conditions—call in Shafer. Shafer engineers have helped manufacturers in practically every industry find the solution to their toughest bearing problems. Important reason is: Shafer engineering skill is teamed up with the basically superior ConCaVex design which combines in one bearing the distinct structural and operational advantages of both ball and roller type bearings.

You may not need bearings with all the advantages ConCaVex design offers. But if you do, you can specify Shafers, confident that they are the best that human skill, quality materials and ultra-modern manufacturing techniques can produce. Call your local Shafer Distributor or write—

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ROLLER BEARINGS

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RATES: Regular Classified (undisplayed) set in this size type: 12 cents per word. Minimum charge, $3. Blind box address in our care counts six words. Replies forwarded without charge. **Situation wanted** ads, 6 cents per word. **Display ads,** set in suitably larger type with ruled border, $12 per column inch; situation wanted display ads, $6 per column inch. Ten **percent** discount for two or more insertions of same copy in consecutive issues. **All classified ads payable in advance. COPY DEADLINE:** 5th of month preceding date of issue. Send copy and checks to: **Trading Post Section, World Oil, P. O. Box 2608, Houston, Texas.**

FOR SALE

■ Well drills, spudders, rotaries, core-drills. All sizes new and used equipment. Tools, drill pipe, cable, pipe. Fishing tools rented. Everything for well drilling. Pressey & Son, Pueblo, Colorado.

■ NORTH DAKOTA AND SOUTH DAKOTA BASE MAPS. Base Maps of North Dakota and South Dakota: County outline, township and range, location of all wells, and operators names with total depths. Oil and Gas Fields. 1"—8 miles. Priced $5.00 each. COUNTY MAPS: fee ownership and lease with expiration dates. Scale 1"—4000 ft. Northwest Mapping Co. 117½ Fourth St. Bismarck, North Dakota.

■ TWO 150 horsepower F and T boilers located at Eunice, New Mexico. Makin Drilling Co., Box 131, Hobbs, New Mexico.

■ Well Drilling Spudders and Rotaries, bought and sold. Immediate delivery in most cases. Specify your requirements. Contact Francisco Gonzales, Baker Export Co. Box 1138, Pecos, Texas.

■ For Sale: One 125 H.P. Allis-Chalmers 1170 RPM 2200 Volt, 31 Ampere, Type A.R. code F, 3 phase, 60 cycle, 24 hour, 40 degree rise induction electric motor. Never used. In original crate, priced at $1500.00. Located Cushing Refinery, Cushing, Oklahoma. Contact Huitt, Deep Rock Oil Corporation, Box 1051, Tulsa, Oklahoma.

■ PERMIAN BASIN WILDCAT MAP OF WEST TEXAS & SE NEW MEXICO. Scale 1"—64,000'. Just like a newspaper—a quick glance and you know what's happening in the Permian Basin. Revised monthly. Single copy $3.50. Midland Map Company, Box 1211, Midland, Texas.

■ FOR SALE: Westcott, Foxboro and Emco Gas Meters, Geo. R. Milner, Box 124, Okmulgee, Oklahoma.

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Largest Known Deposit of
BARITE
Average 90 per cent $BaSO_4$
Near Hailey (southern) Idaho
Complete report available
HARRY A. HERZOG
410 Henry Bldg. Portland 4, Oregon

■ WE WILL BUY Producing Oil Royalties. Send Particulars. Standard Security Co., 111 Broadway, New York 6, New York.

■ I am seeking connections with reliable parties who might be interested in drilling a wildcat oil well in Chino Valley, about twenty-five miles north of Prescott, Arizona. Information on oil indications furnished on request. Box 51-W, c/o World Oil, Houston, Texas.

HELP WANTED

PETROLEUM ENGINEER

For New York office of major foreign producer. Four or more years' experience in drilling, development, and production. To supervise section handling equipment procurement and oilfield development engineering. Position encompasses advising management on oil field development planning, and keeping field colleagues abreast of Stateside improvements in methods and equipment. Salary commensurate with qualifications.

Write giving personal history and work experience. Please include telephone number. Box 48-W, c/o World Oil, Houston, Texas.

WANTED!
MANUFACTURERS' REPRESENTATIVES
Plastic Piping

Exceptional money-making opportunity to handle a complete line of Extruded Plastic Piping manufactured by a well established, experienced Chicago plastics company. Generous commission arrangement. Protected territories. A "natural" for a man with a following in the oil and gas fields. Plastic Piping has stimulated terrific interest and sharply rising volume of sales in both industries because of its non-corrosive, lightweight, easy-to-install advantages. Write full details in first letter.

PERFEX PLASTICS, Dept. W. O.
4344 South Wentworth Ave., Chicago 9, Ill.

■ Manufacturers representative wanted to sell oil field drilling and production equipment in Gulf Coast area. Give complete information including present lines and references. Box No. 50-W c/o World Oil, Houston, Texas.

LEASES

■ 10,000 ft. test proposed for South Georgia as result Geophysical work recent months. For details write C. W. Deming, Waycross, Ga. Ga.

Webber Appointed Chief Engineer Of Oil Center Tool in Houston

Jack C. Webber has been appointed chief engineer for Oil Center Tool Company, Houston.

Jack C. Webber

Before joining Oil Center Tool, Webber was with The Atlantic Refining Company as a mechanical engineer. He was graduated from Texas A. & M. in 1939 with a B. E. degree in mechanical engineering.

He was employed by the Guiberson Corporation in Dallas from 1940 until 1946. During the war he served as an engineering officer on a Navy destroyer for 2½ years.

Madden Named Beaird Sales Engineer

Thomas C. Madden of Dallas has been appointed sales engineer in the packaged compressor division of the J. B. Beaird Company, Shreveport. He graduated in May from Southern Methodist University where he received the Bachelor of Science degree in mechanical engineering. Madden served in the Navy during World War II in the repair and manufacturing of aircraft structural parts. Prior to entering S. M. U. he was an inspector with Consolidated-Vultee Aircraft Corporation.

SITUATION WANTED

Drilling contractor operating in West Texas and New Mexico desires to contact small or medium-sized independent oil company who needs an operating manager. Personal interview desired. Twenty years experience in all phases of the oil industry. Address replies to Box 94-W, WORLD OIL, Houston 1, Texas.

■ Position Wanted: Petroleum Engineer, production superintendent, drilling superintendent. Age 38, presently employed, desires change. Box 49-W, c/o World Oil, Houston, Texas.

■ PETROLEUM PRODUCTION student, International Correspondence Schools, completed Mathematics-Physics, Chemistry, Inorganic; Organic, "B" average, continuing Qualitative Analysis; age 43, wife Mexican National; speak Spanish, tropically adapted. Any type work to begin. Southwestern United States, Mexico. Not labor-union. Cecil Austin, 1341 North Flores, San Antonio, Texas.

■ EXPERIENCED MATERIAL MAN, 18 years foreign and domestic oil field experience covering all phases of warehousing plus assignments in Producing and Drilling, now completing foreign agreement, desires change, must be permanent position with advancement possibilities. Box 52-W, World Oil, Houston, Texas.

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TRUCK LETTERING AND TRADEMARK decals made for your trucks. Easy to apply, uniform, distinctive, economical for small or large needs. Write for Catalog. Mathews Company, 827 S. Harvey, Oak Park, Ill.

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P. O. Box 2608 Houston 1, Texas

New Books, Maps and Movies

PRINCIPLES OF PETROLEUM GEOLOGY, by E. N. Tiratsoo. McGraw-Hill Book Company, Inc., 330 West 42nd Street, New York 36. $7.50.

Both the academic questions relating to the origin, migration and accumulation of petroleum in the subsurface, and the practical problems of discovering and exploiting oil deposits, are covered in this new book. The world's oil fields are reviewed, particularly with reference to their structural and stratigraphic history. The latest techniques of exploitation geology, including petrographic and micropaleontological correlations and electric and radioactive well logging are described. There is a special chapter on the technology of drilling fluids. Exploration methods discussed include surface methods, such as geological mapping, aerial survey and the evaluation of oil seepages and asphalt deposits; and also subsurface methods, and the integration of physics and geochemistry with geology for this purpose.

TWENTIETH CENTURY PETROLEUM STATISTICS. DeGolyer and MacNaughton, 5625 Daniels Avenue, Dallas. $7.50.

The eighth consecutive annual edition of this reference covers 1951 and prior years, and consists of nearly 200 pages with 88 full page charts and 88 full page tables of statistics. Each chart is matched by a table showing figures on which the chart is based. Data in most cases cover the years 1918-1951, inclusive.

Oil reserves, drilling, production, pipe line and refining data for producing areas all over the world are included.

This handbook was prepared initially in 1945 by the Office of the Director of Naval Petroleum and Oil Shale Reserves, Navy Department, Washington, D. C.

GUIDEBOOK, JOINT ANNUAL MEETING AAPG-SEG-SEPM. Pacific Section, American Association of Petroleum Geologists. Copies available from the secretary, Rufus Smith, Continental Oil Company, Edison Building, Los Angeles 17. $6.50.

Published as a guide for the meeting in Los Angeles last March, this 290-page book covers the geological aspects of that region. There are 88 maps, 83 cross-sections, 29 stratigraphic or correlation charts, 11 photos, and road logs of 670 miles of roads. Included also are short illustrated papers on 65 California oil fields and several papers on regional geology.

OIL & GAS FIELDS OF THE TEXAS UPPER GULF COAST. Petroleum News Corporation, Box 331, Houston. $25 to subscribers to Five Star Oil Report; $35 to non-subscribers.

This is the second in a series of 12 district reference books on the oil fields of the Southwest. It reports the geological and development data on all fields in the 29 counties which make up Texas Railroad Commission District 3. Included are field and county maps, discovery data, and information on recovery—yearly and cumulative, number of wells producing, type structure, field potential, deepest test, proration methods, pipe lines, principal leaseholders, and allowables.

THE OILMEN, by Thomas Hollyman. Rinehart & Company, Inc., Dept. 27, 232 Madison Avenue, New York 16. $1.50.

The drama of the oil industry is captured in this 96-page book of 174 photographs, which were selected from more than 4000.

The book was the idea of H. S. M. Burns, president of Shell Oil Company, who hired Hollyman to photograph as many Shell people as he could find in a four-month swing across the nation. Hollyman traveled from California to Connecticut. He traveled by helicopter to shoot field geologists in a California valley, climbed derricks to get drilling crews in Texas, rode a marsh buggy to photograph seismograph parties in Louisiana, dangled 50 feet above ground from a crane to get a bird's-eye view of a new service station in Connecticut.

Hollyman worked with Acme Newspictures and the St. Louis *Post Dispatch* before the war; was a photographer and adviser for Army News Service, *Yank* Magazine, and *Stars and Stripes,* and is now consulting photographic editor of *Holiday* Magazine.

STRONG?

TWO LEBUS LOAD BINDERS HOLD 64,000 LB. LOAD!

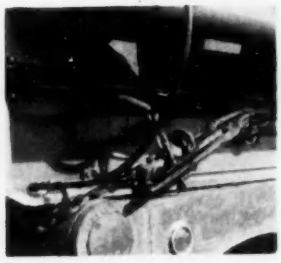
Picture above shows full load of 64,000 lb. rig, after being boomed down with LeBus Load Binders.

"They just don't break"

says CHARLES LITTRELL, Driver, Herman Graham Drilling, Salem, Illinois

In a conversation, overheard about Load Binders, while the above rig was being loaded, Charles Littrell stated . . . "I feel LeBus Load Binders are the best Load Binders on the market." Littrell further said "I have never lost a load that was tied down with a LeBus Load Binder." Littrell was asked if he had ever seen a LeBus Load Binder break when a cheater bar was used . . . His Answer . . . "I have seen as many as four (4) men on a cheater bar and still those LeBus Load Binders wouldn't break. As for making a load safe, I'll use LeBus Binders Every Time."

This photo shows Charles Littrell cinching down LeBus Load Binder No. 1 at the head end of his trailer and load.



Here is a LeBus Load Binder No. 2 on the tail end of the trailer, beneath the engines of this rig.

SEE YOUR SUPPLY STORE or WRITE FOR BULLETIN

LEBUS

LEBUS ROTARY TOOL WORKS

P. O. Box 2352 LONGVIEW, TEXAS Phone 1232

HERE'S WHY
ROUSTABOUTS PREFER

O'Bannon Tubing Tongs

• **Light In Weight:** Made of alloy steel, heat-treated to develop maximum strength and toughness—no excess metal but strong enough for severe service.

• **Easy to Handle:** Snaps on tubing with one easy motion. Drops off when handle is moved back and down, but concealed spring keeps it tight until operator moves to release it. Ratchets easily, but stays tight while spinning.

• **Holds Tight When Bucked:** Body, die and floating jaw are arranged so that the harder the tong is bucked the tighter it grips.

• **Easy to Maintain:** Simple design keeps number of wearing parts at a minimum—only one die to change when worn. Moving parts last well because they are heat-treated to reduce wear.

SIZES FOR:
2", 2½" and 3" Tubing
2" and 2½" Tubing Couplings

Sold By Supply Stores

Walter O'Bannon Company
TULSA 1, OKLAHOMA

SQUEAKS from the BULLWHEEL

"Here comes another guy looking for a job"

Other Things To Do

A small boy in the Ozarks was sent to the woods to call Grandpa to supper. He found him standing silently in the brush, chawin' his favorite brand.

"Gettin' dark, Grandpap."
"Yep."
"Suppertime, Grandpap."
"Yep."
"Airn't ye hungry?"
"Yep."
"Wal, air ye comin' home?"
"Nope."
"Why?"
"Standin' in b'ar trap."

Rear Guard

An old gent was passing a busy intersection when a large St. Bernard ran by and knocked him down. A moment later, a midget car skidded around the corner and inflicted further damage. A bystander helped him to his feet and someone asked him if the dog had hurt him. "Well," he answered, "the dog didn't hurt so much but that tin can tied to his tail nearly killed me."

The Best Things In Life

A great industrialist, upon his return from a visit to Moscow, was besieged with questions. He finally developed a standard answer: "The four nicest things in Russia are the caviar, the Ballet Russe, the subway, and the permit to leave the country."

Going Concern

A large corporation was making a reclassification survey of all the jobs in the organization by sending out a questionnaire to all its employees to porperly fill out.

When the elevator operator received his, he had no trouble answering all of the questions, except one. This question read:

"How much time do you spend at each of your various duties?"

After much pondering, he finally answered:

"Up, 50%. Down, 50%.

Dry Hole

"My wife explored my pockets last night."

"What did she get?"

"About the same as any explorer—enough material for a lecture."

Inside Stuff

Two little children were overheard by a nurse in a children's ward discussing their hospital experiences. Said one: "Are you medical or surgical?"

The other shook his head. "I don't know what you mean," he said.

The first little boy looked scornfully at his friend. He had been a patient in the ward for many weeks.

"Were you sick when you came," he persisted, "or did they make you sick after you came?"

Job Application

Too many of us are like the old Negro deacon who wound up a long prayer by saying, "Use me, O Lord, use me in thy work—'specially in an advisory capacity."

Fast Talk

Money doesn't talk these days—it goes without saying.

Slick Chick

"What's puzzling you?" asked Mamie's girl friend.

"Well, you know I've been going with Simon," replied Mamie, "and I like him a lot. I also have a proposal from Duke."

"So what?"

"I can't make up my mind whether to be ducoed or simonized."

Sexy Story

"How can you tell a lady worm from a man worm?"

"It's easy. A lady worm never signals when she turns."

Short Story

The wolf was too poor to buy etchings, so he asked his girl to come up and see the handwriting on the wall.